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MINERALOGY.

THE WYANDOTTE, KANSAS, GAS WELL.

(BY THE EDITOR.)

Natural combustible gas has been known in various countries from remote ages, and is believed by most observers to result from the decomposition of organic substances, though, in many instances, the sources of this gas have been found to be in geological formations below the coal strata, and especially are such gases frequently found in salt wells and mines.

The most celebrated natural fountains of gas are located in the tertiary formations of the rocky peninsula on which the Russian city of Bachu, on the shores of the Caspian Sea, is built. Through these strata large quantities of naptha and petroleum issue, while volumes of inflammable gas are constantly evolved, giving to the locality the name of the "Field of fire." In the Szlatina salt mine (Hungary) illuminating gas issues at a depth of 90 metres below bank from a marly clay, which is interspersed between the layers of rock salt. This has been known since 1770, and the gas is now collected and used for lighting up the mine. In the province of Szu Tchhouan, China, illuminating gas issues from borings made for rock salt, and is conveyed in bamboo tubes to the furnaces, where it is used for lighting purposes and evaporating the brine. Similar phenomena are described as existing at Arbela, in Central Asia, and at Chittagong, in Bengal.

In the Western Hemisphere such phenomena are by no means rare. In Nova Scotia, for instance, in one of the coal mines, at a depth of 180 feet, a volume of water was suddenly thrown forth with the greatest violence. "The whole mine appeared to be thrown in a state of regular mineral fermentation. The gas roared as the miner struck the coal with his pick; it would go off like the report of a pistol, and at times it would burst pieces of coal off the solid wall. Though no particular exhibition of gas was seen at the surface before the coal was reached in the shaft, the river over its line of out-crop was suddenly thrown into a state of violent ebullition, and the gas could be inflamed upon the surface of the water. It also collected in holes dug in the river bank, and being fired, would burn for months, unless extinguished.

Similar gas bursts have been experienced at salt wells in New York, Pennsylvania, Ohio, Virginia, and elsewhere in the United States, and in several instances the escaping gas has been utilized for illuminating towns, heating dwellings, boiling salt water and heating blast furnaces.

The gas well at Wyandotte, Kansas, described below, is located about one mile above that city, and not more than three miles in a direct line from the court house in this city. Upon visiting it last week we were so unfortunate as to find the occupant of the premises away from home, and no one who could give any definite information regarding it. We were, however, shown into the house and there found it burning in the cooking stove, and saw it lighted up as for illuminating purposes. It burns freely without perceptible odor and gives a clear, soft, light of about three-fourths the power of our ordinary manufactured gas. Tests made by competent experts show that there is no sulphur or carbonic acid present in it, and that, in all respects, it is exceptionally pure. The water has a strong saline taste and contains, apparently, a large proportion of carbonate of iron. Professor T. J. Eaton, of this city, will shortly make an analysis of both gas and water, when we shall be able to give the exact facts. The writer of the subjoined report, Mr. N. McAlpine, is an old citizen of Wyandotte, a close observer and a most reliable gentleman. He has taken a deep interest in this gas well, and the statements made by him may be relied upon implicitly. There can be no question as to the value of this discovery to the people of this vicinity, and we confidently expect that this gas will speedily be utilized, both for domestic illuminating and heating purposes, as well as in the various manufacturing establishments in Kansas City, Wyandotte, Rosedale and Armstrong.

WYANDOTTE, KANSAS, August 9, 1877.

Theo. S. Case, Esq., Editor Western Review:

While reading an account of the Iola gas well and analysis of its mineral water, in the last number of your valuable publication, it occurred to the writer that you would, perhaps, deem worthy of an insertion in the REVIEW a description of the natural gas well (almost at your door) in Wyandotte City.

This gas well was discovered by a company prospecting for coal, about three years ago. After boring a five inch hole to the depth of four hundred feet, the operator reported the drill as having passed through a twenty-eight inch vein of bituminous coal. Just then the workman at the drill was astonished to hear a bubbling, rumbling sound, roaring like distant thunder. It was the gas freeing itself from confinement below, and forcing ahead of it a large body of salt water, as high as the top of the derrick drenching the driller completely. Ever since then the pressure of the gas continues to force the water in jets to the surface. This mineral water, although never advertised, is very much used, with good effect by invalids, both near and far, and the gas (carburetted-hydrogen) has been escaping into the atmosphere, 75,000 feet daily, or enough to light a very large city, ever since.

In Pittsburg, Pennsylvania, three of the largest rolling mills for the manufacture of iron have been supplied, for the past three years, with natural gas exclusively for light and fuel; the gas being conveyed in a seven inch pipe from one well in the oil regions, a distance of twenty-one miles.

This Wyandotte gas is used by the Company in the furnace for raising steam, and by the owner of the farm where the well is located for cooking and light. The gas, whether flowing or burning, is almost odorless. Its entire freedom from sulphur renders it highly adapted for the reduction of silver and gold ores. Sometime ago the Kansas City press advocated the policy of capitalists forming a company for the purpose of reducing at this railroad centre, Rocky Mountain ores, as is done at the works at Omaha. To monied men who contemplate embarking in such an enterprise, it will be information to know there is a hydrogen gas belt in this vicinity.

Notwithstanding a coal vein of sufficient thickness to pay was discovered, the company has concluded to abandon coal mining for the present, with its attendant heavy cost for elevating coal from a deep shaft, and utilize this new gas fuel which rises from the depths to the surface of the earth of its own accord and with pressure enough to force itself in any direction desired.

It is not only suitable for heating purposes, but is very valuable for light; it burns with a clear bright flame without purification, and is free from the disagreeable odor accompanying coal gas.

It is similar to the gas used for so many years to light Fredonia, N. Y., and other towns located in the oil regions of Pennsylvania. Scientific men who have visited this well give as their opinion that the gas is produced by the distillation from coal shale and other minerals by the internal heat of the earth, and that the supply is inexhaustible.

The company, after obtaining the exclusive right to light Wyandotte and Kansas City, Kas., for the term of 20 years, built a tank and gas holder having a capacity of 40,000 cubic feet daily. Recently they have enlisted some of your Kansas City capitalists in their favor, who will furnish the gas mains for the purpose of conveying the gas to light said towns, and ultimately

Kansas City, Mo. No company manufacturing gas from coal can compete long with one supplied by Nature with gas free of charge.

Some parties who have collected statistics from the gas producing regions of New York, Pennsylvania and Virginia, contend that this natural gas business is capable of being developed to an unlimited extent, and we predict that in the near future the people of Kansas City will be furnished in their houses with this light, clean, new fuel, free from dirt, smoke and ashes.

Below find statement of thickness of each stratum passed through, as reported to us by the man in charge of the drilling:

	FEET.
Soil	12
Blue limestone	1
Clay Shale	7
White limestone	13
Bituminous shale	3
White limestone	10
Shale	2
Limestone	9
Grey fossil rock	3
Clay shale	16
Black flint	4
Shale	6
Limestone	19
Shale	5
Limestone	13
Shale	3
Limestone	2
Shale	3
Limestone	7
Clay shale	57
Sandstone	24
Red shale	2
Sand rock	6
Streaks of shale, sand and soapstone	20
Clear soapstone	12
Lime and soapstone	16
Red shale	8
Conglomerate	8
Sand and clay	14
Blue clay shale	9
Dark conglomerate	5
Limestone	7
Coal, (some gas here)	inches, 16
Light clay	" 4
Clay shale, alternate hard streaks	52
Magnesian limestone	30
Bituminous shale	4
(Here tremendous flow of gas and salt water.)	
Good bituminous coal	2
Clay, slate and sand	16
(Here much salt water.)	
Sandstone	75
Coal	inches, 6
Hard limestone	4 ft. 6 in.
Shale	25
Hard fossil rock	2
Coal	1
Very hard limestone	3
Shale	14
Hard limestone	2
Coal	inches, 32
Fire clay	1
Red clay or mineral paint	2
Hard limestone fossil	6
Bituminous shale	10

The amount of water forced up by the gas will fill a pipe 1½ inches in diameter, running constantly.

The illuminating quality of the gas was tested by Dr. Woodward's photometer, and as it comes from the well it is equal to twelve-candle power. At a small cost it can be purified so as to make it sixteen-candle power.

The water, I believe, has been analyzed by Dr. Eaton. The brine is not strong enough to justify the manufacture of salt. It is presumed a stronger vein of brine may be had by deeper boring. The water is highly recommended by invalids, who have used it for its medicinal properties. It seems to contain a large per centage of iron. It also acts as an easy aperient, and performs several other cures too numerous to mention.

This company comtemplate an extensive mineral bath establishment, with hot, cold and swimming baths. Very respectfully yours,

N. McALPIN.

MECHANICS AND ENGINEERING.

TORPEDO WARFARE.

COMPILED BY THE EDITOR.

The magnitude to which this once universally contemned system of naval warfare has attained recently, renders it important to the general reader that the whole subject be condensed into a single article, which has been attempted in this chapter.

The earliest submarine machine for blowing up ships, of which we can find any account, was invented in 1776, by David Bushnell of Connecticut, who called it the torpedo or "American turtle," from its peculiar shape, and was designed to destroy the British shipping during the Revolutionary war. In 1805 Robert Fulton designed torpedoes on a somewhat similar plan, which were also employed for the destruction of British vessels during the war of 1812. In 1854 the Russians employed torpedoes in the Baltic Sea during the Crimean war, and during the American rebellion of 1861 they were frequently used on both sides.

Until a very recent period but two classes of torpedoes have been used, viz: Those self-explosive upon contact with the attacked vessel, and those dependent for exlposion upon an electric current supplied from the shore; and it may be added that until very recently their use has been followed by very meagre and unsatisfactory results.

The government of the United States, however, within a few years past, has devoted much time and expended large sums of money in improving and perfecting the topedo system, and since the outbreak of the war between Russia and Turkey the subject has received far more attention than ever before from all nations. The inventors of England and France in particular have expended a vast amount of ingenuity upon such machines. The result of all this is a development of submarine warfare to an extent which seems about to offset the value and importance which has hitherto been set upon immense guns and steel-plated armors for ships of war. Torpedoes have been contrived to meet pretty much all the requirements of naval warfare, and may be classed as follows: Harbor torpedoes, Spar torpedoes, Harvey (towing) torpedoes, Whitehead (fish) torpedoes and the Lay torpedo.

"The Harbor torpedo is a sort of sunken mine, exploding either by contact or electricity. If these are judiciously laid down around a harbor or anchorage, the approach of hostile ships will be rendered impracticable, provided always they are protected by shore batteries or armed ships to prevent removal. Every channel may be barred by these hidden mines, and they may be made so powerful that any ship under which they explode is sure to become hopelessly disabled. They are fastened to and held in their posi-

tions by anchors or stockades. The bursting charge consists of gunpowder, gun cotton or dynamite; and the case or shell is either made of iron or wood; in Charleston harbor, old steam boilers were frequently used."

"The Spar torpedo is fastened to the end of a spar from 15 to 38 feet long, and explodes also either by electricity or contact. A most remarkable experiment was recently made at Cherbourg, France, with spar torpedoes, carried by a little vessel called the Thorneycroft, which was almost submarine. A very small part of it was above water, but it was of sufficient strength to carry engines and two lateen sails, and it was worked by a lieutenant, two engineers and a pilot. The French Admiral had two disabled ships in succession towed out to sea at a speed of 14 knots an hour. The Thorneycroft, however, was able to go at the rate of 19 knots an hour, a rate not attained by any vessel in the squadron. She very soon caught up with her prey, delivered her blow with a Spar torpedo, which projected from her bow and rebounded. A rent as big as a house was made in the side of the ship attacked and she sank at once."

"The Italian government has already carried out this idea in the construction of her formidable new ironclads, Dandolo and Duilio. The vessels are fitted in their sterns with sort of armored dry dock, harboring a small torpedo steamer. As soon as the services of the latter are required, the dry dock is filled with water and opened and the little craft rushes out at the enemy, returning to her safe berth after her mission has been fulfilled."

"The Harvey (towing) topedo was invented by an English officer in 1862; it was soon adopted by nearly all the other navies, and probably will be exclusively used in general actions at sea as least liable to injure a friendly vessel in the melee. The Harvey torpedo is towed upon the surface of the water by a wire rope towline from a derrick end of the yard arm over or against the enemy; and just before reaching the ship to be destroyed this towline is slackened, and the torpedo, being heavier than water, dives under it. When in this position the explosion is effected by means of a mechanical firing bolt striking down upon a pin as soon as certain levers of the torpedo come into contact with the bottom of the target, This torpedo can also be made to explode by electricity. Two different forms are used for starboard and port."

"Whitehead (fish) torpedoes. This invention is the secret and property of the British Admiralty, but the following details have leaked out: These torpedoes resemble in shape a cigar, pointed at both ends, and are 18 feet long by two feet in diameter. The inside is divided into three different compartments: First, the head, which contains a charge of 350 pounds of gun cotton and the pistol or detonator to explode it; secondly, the balance chamber, which contains a contrivance for setting it so as to remain at any depth at which it is wished to travel under the water line; and lastly, the air chamber which contains the engines and the compressed air to drive them. The after end supports the screws—a right and left handed—which propel the torpedo and are made of the finest steel. The air chamber is tested to the

pressure of 1,200 pounds on the square inch, although for service it is only loaded to 800 pounds. The Whitehead torpedo can be made to go at the rate of 20 knots for 1,000 yards, and at any depth that is desired, from one foot to 30 feet. It can be set to explode either on striking an object or at any particular distance under 1,000 yards—in artillery language, either by a percussion or a time fuse. It can also be set so that if it misses the object aimed at, it will go to the bottom and explode at half cock or come to the top on half cock so as to be recovered, as it has buoyancy enough just to float on the surface of the water when not in motion. It is fired from what is called an impulse tube, which, out of a frame fitted to the port, discharges the torpedo into the water. It can be fired above the water, but will at once go to the depth it is set for, and then go straight to the object, no matter how fast the ship from which it is discharged is going, or how fast the object aimed at may be sailing or steaming."

"Properly speaking, the Lay torpedo, the invention of Mr. Lay, purchased by the United States government, is not a torpedo, but a very ingeniously devised submarine torpedo boat fitted with a spar torpedo. This boat has the advantage of not requiring any crew on board, but in other particulars is capable of great improvements. The motive power consists of an engine driven by carbonic acic gas and a screw propeller. The boat is entirely submerged, and is steered and in other respects controlled by means of an electric battery on shore connected with her by a cable which is coiled up in her hold and pays out as she moves away. Her location is indicated above the surface of the water by a flag, so as to enable the operator to direct her course. The greatest defect of the Lay torpedo is the want of speed. The United States government stipulated for a speed of nine statute miles per hour, but the maximum speed actually attained at the late trial trip, when it was steered by Lieutenant R. B. Bradford, U. S. N., showed only an average of 6.60 miles per hour, so that a ship attacked would only have to lower her boats and let them row between the approaching torpedo and the shore, and cut the cable, which would leave the torpedo at their mercy."

The English papers notice the invention by Rev. Mr. Ramus of a new torpedo called a "rocket float," propelled at the rate of 275 miles per hour, for a distance of four miles, on the surface of the water. The apparatus is described as a timber or iron vessel, the bottom of which is a series of inclined planes. In the head is the explosive, and enough gun cotton can be carried to blow up the largest iron-clad in existence, while the rocket, by the combustion of which the craft is impelled, is laid along the deck. The vessel is guided by a rudder of thin sheet metal.

The torpedo steamer "Alarm," designed and constructed under the supervision of Admiral David D. Porter, of our own navy, is probably the most destructive, as well invulnerable, craft of the kind afloat. She is also an excellent and most buoyant sea boat, admirably arranged for the comfort and convenience of her crew and officers. She is 172 feet long, including a ram or beak

32 feet long. She is steel-clad and is so constructed as to have really two hulls one outside and so far separated from the inner one that a person can pass from one end to the other between them. In addition to her terrible ram, she carries two spar torpedoes. We copy from the *Scientific American* a brief description of her action in a naval fight:

"Having sighted an enemy—say at night—her compound engines drive her headlong at him at the rate of 15 knots per hour. As she nears him, the immense electric light on her bow flashes out its glare, blinding her adversary to her own hull (which is already sunk so low that her deck is but three feet above the sea), while displaying his every proportion. The roar of her 15-inch gun, as it hurls its huge shot or shell into the attacked vessel, is followed by the crash of the bow spar torpedo striking the devoted craft thirteen feet below the water line. Then, perhaps after a momentary check due to the torpedo recoil, the Alarm plunges forward, driving her immense ram into her adversary's crushed side. As she swings broadside on to her foe, another torpedo spar shoots out from her side, and another torpedo is exploded under the unguarded bottom of the enemy; while the machine guns on the torpedo boat's rail keep up a deadly fire of thousands of bullets per minute, sweeping her opponent's decks."

The Russians have adopted a system of small steam launches, steered by electricity, or by a man or two on board, who are protected by a bow screen and bulk-heads. These launches can be run directly under the side of a large vessel, under cover of smoke or darkness, and deal destruction to an enemy before their approach is observed, or even if observed, they are too small to be readily hit by a shot from the ship.

Among the defences proposed for vessels of war against torpedoes, are wire or rope netting, or screens, suspended to booms overhanging the vessel's sides, an electric light which shall dazzle the eyes of the seamen managing the torpedo boats, smoke clouds from the burning of smoke balls to conceal the whereabouts of the ship, and finally, the entire change of construction of naval vessels from iron-clads, which are so easily sunken and are so costly and unwieldy, to vessels constructed almost solidly of wood, so that they cannot be sunk, and yet are lighter and more readily handled than those at present in use.

METALLURGY.

THE MONNIER PROCESS OF REDUCING REFRACTORY ORES.

Mr. J. W. Wright has lately investigated this process at the Providence Mine, near Nevada City, and makes the following report to the *Mining and Scientific Press:*

This valuable mine is owned by Messrs. Walraths and Hunter. During the last six months they have been preparing for the introduction on this coast of this new method of reducing ores, and for more than a week past their works have been in successful operation. This is the method of reducing refractory ores by roasting and lixiviation, as invented and patented by Alfred Monnier.

Being kindly afforded every facility to investigate this method of extracting the precious metals so entirely new to our coast, I shall try, by aid of the Professor's explanations, and the accompanying diagram I have made of the ground plan of the works, to give your readers some idea what this method is, how it differs from, and what its advantages are over the usual method.

These works are on a steep hillside. Going from A, the highest point, to B, the lowest, you descend from floor to floor some 20 feet. The shaft and hoisting works are about 100 feet to left of point 1. The order of arrangement of cylinder, tanks, arastras, etc., will naturally vary according to the surface to be built upon.

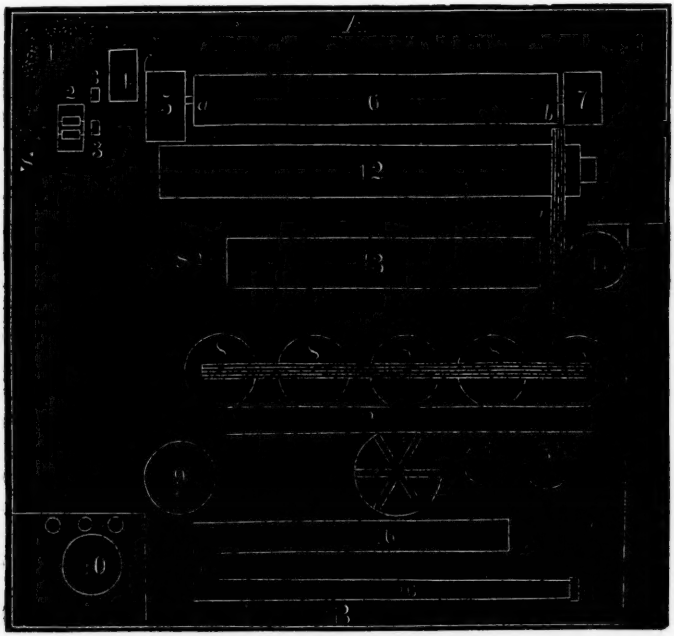
1. Lump ore from mine. S. Sulphate of Soda. 2. Rock-breaker and crusher. 3. Elevators which carry crushed ore and soda to 4, receptacle of same, whence, through 5, they are conducted into 6, revolving cylinder, where the mixture is roasted. 7. Fire-box of cylinder. 8. Lixiviating tanks. 9. Reservoir for lixiviating tanks. 10. Reservoir for strong solution. 11. Feeder for evaporator. 12. Evaporator. 13. Crystallizing tank. 14. Arastras. 15. Feeder for copper-plate in 16, amalgamating trough. P. Roasted and lixiviating ore ready for arastras. S2. Sulphate of soda taken from crystallizing tank. *b*, point where iron car receives roasted ore. *t*, tramway over which car passes to lixiviators.

What are known among miners as "refractory ores," are those containing a large proportion of metallic sulphurets. The method long in vogue in what are called the "sulphuret works" of our mining regions, is that of *chlorination*, where common salt, manganese, and sulphuric acid are used, and must be purchased for that purpose. The Monnier method for the treatment of metallic sulphurets may be correctly distinguished from the former as the method of *sulphatization*—a term suggested by Prof. Monnier—since its chemical processes consist in changing into sulphates the sulphurets of different metals contained in the quartzose ore.

The Messrs. Walraths and Hunter have been working their mine about six years, reducing the ore by the common method of chlorination. Their shaft is down something more than 800 feet, with the usual drifts every 100 feet. Some twenty men are now at work in the different drifts, and the ore brought up daily is a very fine quality of sulphurets. The chemical compounds it contains, besides the pure silica of the quartz, are sulphurets of silver, copper, iron, zinc and lead, containing gold, also small quantities of arsenic and antimony. That portion of the ore which is reduced by the Monnier method is treated as follows:

XUM

The crude dry ore in lumps (1) is mixed with sulphate of soda (5) and passed by the shovelful into the rock-breaker and thence between Cornish rollers (2). The proportion of the mixture is 20 lbs. soda to 80 lbs. ore. Through one elevator (3) the crushed mixture passes to a wire sieve with 24 holes to the linear inch, *i. e.*, 576 to the square inch. From this sieve the coarser particles return by a chute to the rock-breaker, the finer pass through it into a second elevator (3), which conducts the finely pulverized and dry material into a large box (4), whence it is passed regularly through a small chamber of brick and iron into the huge revolving iron cylinder (6), which is five feet in diameter by 40 long.



Ground Plan of Providence Reduction Works.

The roasting is here accomplished. This cylinder is revolved very slowly by water power. Its upper end (*a*) is raised six inches above the level of the lower end (*b*). This elevation can be increased, according to the proportion of the sulphur in the ore. The cylinder has now been revolving without intermission for a month. Its slow motion causes the roasting mixture to gravitate gradually towards the lowest level, and some 12 hours are required for the crushed sulphates to pass from the upper to the lower end of this revolving cylinder. It thus contains at one time about seven and one-half tons of the ore, since about 15 tons are reduced by this method every 24 hours.

An intensely heated draft of air passes steadily from the fire-box (7) into the lower end of the cylinder. The mixture is thus heated to a high degree, until at the lower end (*b*) the ore reaches a dark red heat. This roasting within the cylinder gradually transforms the sulphurets into sulphates and the gold is set free. Chemically this is explained by the sulphur becoming oxidized and forming sulphuric acid. This combines with the soda, forming a bisulphate of soda, the decomposition of which reduces successfully the sulphurets of iron, etc. A considerable quantity of sulphurous acid is also formed and escapes from the cylinder. The resulting sulphates being soluble in water, you can look with safety from the upper end of the cylinder through its entire length, and see myriads of brilliant scintillations flying to and fro, and falling like so many meteors in miniature. These are caused by the union of sulphur with the oxygen from the atmospheric air. The degree of heat required is maintained by consuming in the fire-box half a cord of mountain cedar each 24 hours. The red hot ore passes at *b* into an iron wheelbarrow, which is trundled by one man along tramway (*t*), passing over five huge wooden tanks (8), made on the Monnier plan, and partly filled with water at its natural temperature. Here the process of lixiviation begins. The man who handles the wheelbarrow takes the roasted ore from it by the shovelful and drops it into any one of the lixiviating tanks. Quite a detonation follows as each shovelful is thrown in. This is continued until each tank receives its allowance.

By a set of rubber tubes connection is kept up between the liquid in three of the tanks at a time, thus forming a battery.

When the water in any of the five tanks holds in solution the largest possible amounts of sulphates of silver, copper and soda, it is sent by a tube into small tanks filled with cement copper by which the silver is precipitated. Thence the remaining liquid is run into a reservoir (10). This is done in what is called the silver room.

Any weaker solution is passed into another reservoir (10), to be used again in lixiviating till it attains sufficient strength.

From the reservoir (10) the solution is conducted by a wooden pump and trough into a tank under tank 11. Thence it is raised by a wooden pump into the latter tank, which serves as a feeder (11) for the evaporator. This huge evaporator is filled through a wooden trough from tank 11, and the liquid in it is kept at boiling heat by the hot air passed into it from the revolving cylinder and the fire-box.

After a certain time allowed for evaporation the remaining liquid is passed by rubber syphons from the evaporator into the crystallizing tank (13). This tank now contains only sulphates of copper and soda in solution. As the liquid cools, the sulphate of soda crystallizes, and is drawn out by an iron hoe with a long handle into a pile (*s2*), to be used over again to repeat the process *ad infinitum*. The amount lost is scarcely appreciable.

The copper in solution is then precipitated by iron. All the round tanks are about the same size, having a capacity of some 700 cubic feet. The five

used for lixiviating each holds 25 tons of ore, besides the water needed to dissolve the sulphates of silver, copper and soda.

We will now return and see what becomes of the residue of insoluble matter left in the lixiviating tank. It consists of silica, pure gold and sesquioxide of iron, also a small amount of silver with sulphate of lead. When the liquid has been drained from it, it is shoveled out on the platform (P), from which it is passed into the surface (14). After mixing with water and thorough grinding it runs into the feeders (15)—which act also as reducers of the remaining sulphate of silver—and thence through wooden spigots and troughs into the broad, shallow and long troughs (16), provided from point to point with boxes or catchers of peculiar construction. The bottoms of these boxes and troughs are covered with amalgamated copper plates. Here the gold is so free it is immediately taken up by the quicksilver and with the remaining silver is secured in the form of an amalgam, while the residuum, containing oxide of iron, passes outside of the building to a large wooden tank. From that the oxide is collected in a still larger tank, where it settles, and is collected and dried. Mixed with oil this oxide of iron makes the purest of metallic paints—its natural color reddish brown—and is the very best that can be used on all iron structures. By combining different ingredients with it various colors can be produced. It makes a first-class fireproof roof paint.

We shall close this description by stating some advantages of sulphatization over chlorination, as is proved at the Providence mine.

By chlorination much of the coarse gold may be lost, and no silver can be saved. Sulphatization usually saves from 92 per cent. to 95 per cent. of the gold, and leaves it in such a free state that quicksilver takes it up at once.

To chlorinate gold some 48 hours are generally required. The method of sulphatization requires but 12 hours. Chlorination extracts gold only. This "Monnier method" extracts gold, silver, copper and oxide of iron. Then these better results are obtained at a greater reduction of expense in labor and fuel, and the expense of buying sulphuric acid, manganese and salt is avoided. It takes one man at the roasting cylinder in the Monnier process, and half a cord of wood, in twelve hours, to sulphatize fifteen tons of ore, when by other processes, such as chlorination, it takes three men and one cord and a quarter of wood for one ton and a quarter of ore.

The only material purchased in sulphatizing is sulphate of soda at a trifling expense, while the method produces its own sulphuric acid. As has been shown, the soda can be used again and again with scarcely any loss.

When we remember how rich in sulphurets are the almost exhaustless quartz leads of our mountains, we can scarcely overestimate the value of this successful introduction of Prof. Monnier's method on the Pacific coast.

The Professor informs me that the application of the revolving cylinder in this method is new and far surpasses expectation. As to the other apparatus, it has been brought step by step to its present state of perfection by its use in the Eastern States in the treatment of 14,000 or 15,000 tons of sulphuret ores.

METEOROLOGY.

The Importance of a General System of Simultaneous Observations of Atmospheric Electricity.

BY W. E. AYRTON AND JOHN PERRY,

Professors in the Imperial College of Engineering, Tokio, Japan.

The great practical value of simultaneous meteorological observations is the assistance they afford us in enabling fairly accurate predictions of the weather to be made some hours in advance.

But all these observations are derived from instruments like the barometer, thermometer, etc., which are only affected by the air or other bodies in their immediate neighborhood. A disturbance produced in the higher regions of the atmosphere cannot possibly affect the barometer or thermometer until this wave of disturbance has traveled down to the lower air strata, whereas electrical and magnetic instruments are instantaneously sensitive to disturbances produced at great distances: the pneumatic despatch and the electric telewraph may, in their difference of speeds, be taken as fairly analogous with the sluggish barometer and ever-watchful electrometer.

Dr. Veeder has drawn attention forcibly to the fact that even surface winds, although they affect the weather, produce no change in the barometer.

Now, since the value of all storm warnings increases with the time by which they precede the danger, the day may come when electrical and magnetic observations may not only aid, but actually supplant barometric observations.

Mr. Cromwell Varley, the well-known electrician, having noticed that on several occasions earth currents were followed by a change of weather, communicated this fact to Admiral Fitzroy, who found such information so much assistance to him in predicting the coming of storms, that he requested to have it regularly supplied. "On some occasions," says Mr. Varley, "Admiral Fitzroy could see the approach of a storm days before the barometer indicated anything of the kind."

Our present knowledge of this subject may be summed up nearly in the words of Sir William Thomson in his address as president to the Society of Telegraph Engineers. Suppose for a moment that there were no electricity whatever in the air—that the air was absolutely devoid of all electric manifestation, and that a charge of electricity were given to the whole earth.

Well, now, if space were non-conducting—and experience on the vacuum tubes seem rather to support the possibility of that being the correct view—if all space were non-conducting, our atmosphere being a non-conductor, and

the rarer and rarer air above us being a non-conductor, and the so-called vacuous space, or the interplanetary space beyond that (which we cannot admit to be really vacuous), being a non-conductor also, then a charge could be given to the earth as a whole, if there were the other body to come and go away again, just as a charge would be given to a pith-ball electrified in the air of this room. Then, I say, all the phenomena brought to light by atmospheric electrometers, which we observe on a fine day, would be observed just as they are. The ordinary observations on atmospheric electricity are precisely the same as if the the earth were electrified negatively, and the air had no electricity in it whatever. In rainy weather, however, the potential of the atmosphere referred to that of the earth is sometimes positive and sometimes negative.

Observations made everywhere in the northern hemisphere tend to show that the potential is greater in summer than in winter, but the months of maxima and minima appear to differ at different places. Observations made at Kew and Windsor in Nova Scotia show distinctly two maxima in the year, those at Brussels and Kreuznach only one. Both the Kew and Brussels observations show two maxima daily, at 8 a. m. and 10 p. m. in July, at 10 a. m. and 7 p. m. in January, and at about 9 a. m. and 9 p. m. in spring and autumn. Although, therefore, all the tests made at different parts of the earth's surface in fair weather (except some of doubtful meaning made at the peak of Teneriffe in the early days of the study of this question) have shown the earth's surface to be negatively electrified, the amounts of electricity existing at the same time at different places will be very different; and this difference manifests itself in a manner often extremely disagreeable to the telegraph engineer—in natural line currents.

The country in which these natural line currents have been most carefully studied is undoubtedly British India, since the uniform system of land line testing employed in the Government Telegraphs throughout that country causes the accurate measurement of these currents to be daily carried out. From the results of 10,000 such measurements it is seen that in India the direction of the current is far more constant than its magnitude, and on the whole there appears to be a marked preponderance of currents of positive electricity flowing from the East to the West—that is, with the sun; and such a current the laws of electro-magnetism tell us would be consistent with the earth's magnetism.

Observations made on the Atlantic cables tend to show that when there are no unusual disturbances the earth currents at one end have two positive maxima and two negative maxima daily. Submarine cables, however, even when long, are far less disturbed by terrestrial currents than land lines, which may possibly be due to the sea having a far greater electric conductivity than the land.

Since the early days of telegraphy a large number of observations of natural currents have been made at the principal London Office in Telegraph street, the results of which were communicated to the Astronomer-Royal.

These tests seemed to show that natural currents in land lines were the continuations of the submarine currents which were arrested by the comparative non-conductivity of the land, for on Mr. Varley's endeavouring to find the neutral, or equi-potential, line for the currents of the east coast of England, he found it to coincide approximately with the shore line.

During auroras these currents become extremely strong, sometimes as great as can be produced by the employment of a battery of 2000 of Daniell's cells, and occasionally even exceeding this. Of such currents the most extensive set of simultaneous observations that have been made was during the remarkable aurora of February 4, 1872; but as on that occasion these observations were not the result of any general system of measurement, but owed their origin to the fact that the currents became so strong as to interfere with the working of all the telegraph lines throughout the world, it cannot be expected that any large amount of information can be derived from the mass of records made on that day. One point however can be learnt from these observations, and that is this—first, the general direction of the positive currents was from East to West, that is, with the sun; secondly, along lines running North and South the currents were comparatively weak.

There seems to be no doubt now that the earthquakes are preceded, or accompanied, by unusual strong natural currents in telegraph lines. As far as we are aware, attention was first drawn to this by one of the writers of this paper in a communication made to the Asiatic Society of Bengal, in June, 1871, in connection with the Indian earthquake of February 16, of that year. The Indian earthquake again of December 15, 1872, preceded by such strong earth currents during the evening of December 14th in the land lines from Valentia to London, that in order to send messages it was neccssary to loop the lines, by means of which the current in the one line was made to neutralize that in the other. The Egyptian earthquake of January 12, 1873, was preceded for some days by equally strong natural currents. This earthquake was also accompanied by an eruption of the volcano Shaptar Jokull in Iceland, which lasted from January 9 to January 12, and it is interesting to notice, as Mr. Graves, of the Atlantic Cable Co., has pointed out, that a direct line drawn from Cairo to Iceland crosses the telegraph wires from Valentia to London. Again, the Italian earthquake of March 17, 1875, was accompanied by great disturbances on the land lines of Italy.

From what has preceded, it may be concluded with a fair amount of certainty, that (1) atmosphere electricity, (2) auroras, (3) earthquakes, (4) magnetic distances, (5) natural currents in telegraph lines, (6) sun spots, and (7) wind storms, are all linked together, and we feel that if this is shown, nothing more is needed to induce thinking people to interest themselves in the subject of this paper.

As regards the method of measuring the atmospheric potential, we have not much to add. Sir Wm. Thomson's quadrant electrometer, combined with his water-dropping collector, forms a very delicate measuring apparatus for observatories, and can easily be made self-recording; his probable

electrometer and burning match may be used instead by travelers, or when neither very delicate observations nor automatic records can be taken.—*Abstract from Proceeding of the Asiatic Society of Japan—London Telegraphic Journal.*

PALÆONTOLOGY.

REPORT OF DISCOVERY OF MASTODON TUSK.

BY H. H. WEST.

Absorbed alone in the present, amid the busy scenes of life, we little dream of the silent past until accident has revealed, hidden perhaps at our very feet, some strange monument, some mysterious vestige of a long bygone age, to recall its reality. An accident of this kind has thrown in our way a relic of the largest of the extinct terrestrial mammals, and recalls to our minds the wonderful life of the Post-glacial time.

Last June I found on Campbell street, about one hundred and fifty feet north of Independence avenue, a fragment of the tusk of the mastodon It was at the bottom of one of those deep channels, caused by the natural drainage, so characteristic of the loess, imbedded in the upper part of the drift. The piece secured is only two and one-half feet in length, with a diameter of four and one-half inches at the larger end, and two inches at the smaller, but the tusk was traced for a distance of five and one-half feet, and was probably considerably longer, as the base and apex are both wanting. It was so badly decomposed that it was saved with difficulty. Small fragments were found scattered through the clay and gravel for several inches around it, evidently broken and scaled off at the time it was deposited.

The following section will better show its geological position :

Buff loess loam.....10 to 15 feet.
Gravelly bed—gravel consisting of chert and argillaceous shale .....6 inches.
Sandy loam, sparingly interspersed with fragments of chert and shale.. .....5 feet.
Gravelly bed, with limestone fragments, containing *productus longispinus, terebratula bovidens* and a small trilobite. This gravel is probably all derived from the rocks in the immediate vicinity,.....6 inches.
Sandy loam, penetrated by many vermicular tubes and and small pockets filled with black and greenish material. The lower 8 inches contains drift pebbles.....2 ft. 6 in.
Sandy clay, with pebbles and boulders of granite, greenstone, quartzite, kidney-ore (spathic iron), quartz, etc.....1 foot.

In this bed the tusk was found. Several feet of obsoletely stratified drift sand, with pebbles and boulders are found in the gully below this.

CHEMISTRY.

THE MATERIAL RESOURCES OF LIFE.*

BY ALBERT B. PRESCOTT.

To be able to live, in any way known to us, it is indispensable to have a body. And, as living bodies come by growth and continue by nourishment, it is first necessary to have materials whereof bodies can be made—and renewed and kept in warmth and strength. Just these materials, with the permission of the reader, we will try to take account of, as resources of life. Life is not maintained "by bread alone;" other needful resources being known to physical science, and still other resources greater than all being recognized by their results in life; but we have the bread alone, as enough, certainly, to be considered in the present article.

Living things are in very deed made of "the dust of the earth;" but it is by no means all of the dust of the earth that serves this purpose. We have to distinguish between substances out of which organized instruments of life can be made, and a much larger number of substances never used in the making of these instruments.

We have it in mind that matter is made up of sixty-three simples. At all events, the earth's crust and air are constituted, substantially, of these sixty-three sorts of atoms, and, as a good many of the same are already revealed in the sun and stars by the spectroscope, it is likely that they are the chief elements in the universe of matter. Of the sixty-three, certain elements, found only in very small quantities, appear to be of subordinate importance in that part of the universe under our immediate observation, whatever purposes they may fulfill in other earths or in the centre of our own, or at other epochs. Others of the elements bear an important part in the structure of the globe or in the uses of mankind, but are not organizable materials, and they are not in our present consideration. Of the sixty-three, only fourteen or fifteen simples, about one-fourth of those known to us, are used in the construction of plants and animals. These, then, are before us, as the elemental resources of life.

It will be understood that the tissues are not built directly of these fourteen elements, but of their chemical compounds. Each one of these compounds is a definite substance in external character distinct from its

*An address given before the Detroit Scientific Association, December 13, 1876.

constituents, as, in a familiar example, water is distinct from the hydrogen and oxygen of which it is composed. The number of these chemical compounds built into living tissues is very great, a number uncounted. It is of these compound substances—of their molecules—that the cells are builded; builded by an action very unlike chemical action and into shapes very unlike chemical results. Also, it is by the consumption of these compounds of the fourteen elements that animal warmth and activity are sustained. But, not turning aside here to question the chemistry (the making of molecules) going on in cells, or the vital organization (the building together of molecules) going on in cells, not once lifting our eyes toward any of the dynamical sources of life, we bend our attention to find out, if we can, the raw material for cells, the inorganic resources of the organic world.

It is the organic world together, to be sure, that is able to subsist on the fourteen elements as these are given by the earth, the animal kingdom obtaining most of its material at second hand, as elaborated by the vegetable. The two kingdoms are, in the end, mutually dependent on each other in gaining sustenance from the earth's supplies.

The fourteen indispensable simples may be classified, in different ways for different ends. There is a privilege of provisional classification, for the sake of comparison and of acquaintance; and, with the promise not to impose our arrangement upon any other occasion, we would like, for the purpose of our present quest, to divide the elemental resources of life into two categories, as follows: 1. Those supplied so abundantly on the earth that all individuals share them alike, without favor of fortune or forethought of mind. We may name them redundant resources. 2. Those provided so sparingly that individuals do not share them alike, but secure them by effort and by opportunity. They may be termed adequate resources.

From the provision of the first class of materials, it results that, in certain great essentials of organization, all individuals are placed on a footing of equality with their fellows. It results from the provision of the second class of materials, that unequal qualities and quantities of organization are derived by different individuals of the same species. Through our redundant resources we are taught the common brotherhood of the created. Through our adequate resources come the assurances of our responsibility —our commissions as stewards of the earth. Materials given in a superabundance that cannot be wasted constitute a dispensation of mercy; its benefits falling alike on the just and on the unjust, the lazy and the diligent, the foolish and the prudent. Materials given in a competence that must be guarded constitute a dispensation of compensation; inciting to exertion, rewarding for attainment, and training the powers of volition. By the first, the democracy of equal privileges and inalienable possessions is maintained; by the second, the aristocracy of merit is preserved.

The redundant resources so abound that they can have no value, in the

sense of exchangeable value, in society; even though needed as they are in more constant supply than those of the other class. The resources which are barely adequate are those which come to be objects of personal possession; they are the things of which mine and thine are declared, and it is because of them that title-deeds are drawn and prices-current established. The substrata of poverty and of riches rest in the chemical elements.

With the definition of each class in mind, let us now consider the supply of some of the more important of the elemental resources. From the fourteen, let us take at least three elements of each class, as representatives. For the redundant resources, we will take carbon, oxygen and hydrogen. Then for the adequate resources, we will examine nitrogen, phosphorus and potassium.

Carbon is the one element never left out of a organic compound. Its atoms are not only constituents, they are corner-stones of all the organic molecules. In the human body, thirteen parts in a hundred, or forty per cent. of the solids, are carbon. Looking for its supply, we see that it is obtained for the organic world by the plants, and from the carbonic-acid gas of the air. It is taken from the air chiefly by the leaf of the plant. How much carbon is taken from the organic mould of the soil and from acid carbonates, through the roots, is perhaps not fully settled; but we are well assured that the main and sure resource of the plant for this element is the air. The supply, then, is as abundant and impartial as the open air itself. The carbon material forms but a small part of the air, it is true, only about five parts in 10,000; nevertheless, it is enough, at least for the average rate of vegetable nutrition. Carried around the globe in the viewless air to every plant alike, the carbon-atoms are supplied for the framework of every cell in plant and animal. A dwarfed shrub or rootless lichen, clinging to the crevices of a naked rock on a frigid shore, has at hand a good supply of the same resource that is furnished to a luxuriant palm spreading from a tropic soil.

And the carbon-supply in the air is not a reservoir diminishing, however slowly, from age to age; but, to be sure, it is a returning fountain, replenished from the exhalations of animals and the decomposing remains of all organized bodies. In Nature's economy, the same carbon-atoms are used over and over again as material for organization. This perpetual replenishment, a thrifty provision against future exhaustion, is one not peculiar to carbon, but it is a provision made in good degree for every one of the elemental resources of life, whether redundant or only adequate in its immediate supply.

That plants feed upon the carbonic acid of the air is known to the school children, and has been known to men for a hundred and one years at least. Priestley, whose discoveries were celebrated in the chemical centennial at Northumberland, Pennsylvania, two years ago, placed it on record very clearly that "air vitiated by animal respiration is a pabulum to vegetable life." This was but the next year after Priestley's discovery of oxygen itself; yet to this day there lingers in our common thought an

undefined impression that the carbonic acid of the air is just an impurity, tolerated because there is only a little of it, but an impurity that it were as well to be rid of altogether. Now, if the redundant resources of life were at our human disposal, we might be in danger, some day, in the sheer forgetfulness of self-regard, of throwing away as an impurity the very foundations of sustenance. Some one, perhaps, would set forth that this gas when not diluted is immediately fatal to human life; another would declare, "Once a poison, alway a poison;" and another would ask why we should imperil our own health for the sake of the plants.

Oxygen was named next, among the primary resources, redundant in supply. It is a prominent constituent of all living tissues, forming seventy-two parts in a hundred of the human body with its fluids. It is taken in two conditions: first, in combination, chiefly by the plants; second, in the elemental state, by animals. In combination, it is taken by the plants from carbonic acid gas, just noticed as a source of carbon; from water, to be considered as a source of hydrogen; and, in smaller quantities, from a considerable number of other substances. The greater part of the oxygen in animal tissues is obtained in the products elaborated by the plants.

But for all animal life the most imperative demand is for oxygen in the elemental state.

The other elemental resources are available only in their compounds; oxygen does its best service when alone. The others serve life as materials for its bodily tissues; oxygen has an additional duty, the maintenance of operations giving warmth and strength. The activities of life consume various materials, but most constantly of all they demand a raw material of inorganic nature, a simple material in its primitive condition. This supply of elemental oxygen, a necessity for all animal life, is a necessity that is imminent in direct proportion to vital activity, and for man is absolutely imperative. When supplied with oxygen, we can subsist days without other food; when deprived of oxygen, life fails in a few minutes. It is scarcely a figure of speech to say that the breath is the life. The energy of oxygenation is told in every stroke of the heart. The food that is eaten does not raise an iota of bodily strength without the help of the pound and a quarter of pure oxygen that is daily inhaled. To breathe poorly is to faint; to eat richly and breathe poorly is to suffocate and perish.

The supply of elemental oxygen is certainly impartial and bountiful without reservation. It is more than given—it is pressed upon us; to escape from it is a work of toil and difficulty. No one is poor from want of it, or rich from gain of it. Were it furnished for pay, all that a man hath would he give for an hour's supply of it. The poor, taken together, fare best in its use; while the wealthy, in their elaborate contrivances to exclude the cold and wet and wind and glare of the weather, can make but slight impediments to its distribution.

One other element we were to inquire of, among the redundant materials: the unit of chemical measures, hydrogen. As light as it is, it makes

over nine weights in a hundred of the body of man. It is obtained chiefly by the plants; mostly from water, but to some extent from ammonia, the the latter being more notable as a source of another element.

Water is not quite always as free as air—failing the needs of the stationary bodies of plants more often than it does the wants of animals, and in the quantities taken as food by man hardly liable to a notable value in exchange. As a substance not wholly gaseous, it is not easy to conceive how water could be more abundantly supplied than it is, without being a burden and a hindrance to life. It is doubtful whether mankind would vote for any uniform increase in the quantity of water on the planet. If water was supplied in vapor more abundantly than it is, by having a lower vaporizing point, the conditions of all life would be changed—the atmosphere would be put out of its adjustment with the organic creations.

Some of the simpler forms of life subsist almost wholly upon the three elemental materials we have had in consideration, with a few others of the plentiful resources; and living beings taken together use much larger quantities of these than of the substances more sparingly supplied. But, as to the relative importance of the two classes of resources, it can only be said that the higher forms of life can no more exist without the one than without the other.

Of the adequate resources, nitrogen is needed by the largest number of living bodies and used in the largest quantities. It enters into most animal tissues and the more complex of the vegetable products; being two and a half parts in a hundred of the body of man, or eight per cent. of all its solids. It is obtained for the organic world solely by the plants, and obtained only from combinations of nitrogen, the ammonia and nitrates of the air and the soil.

The supply of this combined or available nitrogen in the air is limited—enough for a measure of vegetation, but not near enough for the greatest growth of food-plants and grains. The quantity of combined nitrogen carried by the rain from the air to the plant roots was found to be, in the rainfall of a year in Great Britain, equal to seven pounds of ammonia on an acre; another year it equaled nine and a half pounds per acre. The constituents of wheat are such that twenty-four bushels require the nitrogen of forty-five pounds of ammonia; that is, for the crop on a given surface, about five times as much as the rain furnishes. Plants doubtless gather directly from the nitrogen compounds of the air without help of the rain, and obtain a larger supply from the organic mould of good soils; but that all these sources together provide hardly enough is pretty clearly proved by feeding the roots of the plants with additional nitrogen compounds. On all but the richest soils, the suitable application of ammonia or nitrates causes a notable increase in the quantity of food-plants, and also causes an increased proportion of the nitrogenous constituents of plants. If nitrogen compounds could be laid down cheaply enough, it would augment the supplies of food and raiment, and the comfort of man, in no small degree.

Right here it comes to mind that uncombined nitrogen forms over three-fourths of the weight of the air—a provision of about eleven pounds on every horizontal square inch—and a question rises, "Why cannot the vital forces take hold on the pure element and use freely from its most lavish supply?" Well, because the universe exists. The stomach does not digest the carbon of charcoal; nor do the lungs take oxygen from water. To propose any alteration in the character of one of the sixty-three elements is to undertake the reconstruction of the universe. It is the character of nitrogen to refuse chemical combinations. Uncombined nitrogen is nowhere available for vital uses, to any appreciable extent. Filling perfectly its humble service in Nature as a diluent in the air, its qualification is to be inert and to remain changeless. Among the resources of life and in the marts of subsistence where its compounds rank high in value, nitrogen as a simple has no place at all.

This barrier between nitrogen and its compounds seems to hold firm from age to age. Out of the ocean of atmospheric nitrogen the plant selects the scattering molecules of nitrogen compounds and elaborates therefrom many nitrogenous substances. The animal elaborates some of these into other compounds. But in the final decay of products and tissues, and food not assimilated, the nitrogen of all returns again to ammonia—again in the aërial ocean, and again the resource of plants. If ammonia is oxidized in the air to nitric acid, the latter is deoxidized in the soil to nitrous acid and then to ammonia. All these compounds are very frail, and change most constantly, but together they hold the little stock of united nitrogen, losing little of it and gaining little for it, from epoch to epoch.

There are leakages, to and fro through this remarkable barrier, it is true, but they are so small that little is known of them, except that they show the strength of the barrier that limits them. On the one side, there is a little loss, by the liberation of traces of nitrogen in its certain organic decompositions. Also, the explosive agents used by man in warfare and the arts result in the liberation of nitrogen—an expenditure of life-resources. On the other side, by the electrical disturbances of the atmosphere, traces of nitrogen are brought into union. The roll of thunder indicates the restoration of a modicum of that good material which was wasted for the roll of artillery. Again, it is believed that in organic decay under restricted conditions some measure of nitrogen is brought into union with nascent hydrogen

Chemical art has not done anything toward the appropriation of this obstinate element. Nothing nitrogenous can be made of nitrogen. The manufacturers depend on gatherings from the sparingly distributed nitrates of the earth. As machinists have dreamed of perpetual motion, sleeping chemists may dream of an invention to bring atmospheric nitrogen into use, that all the barren places may be made fertile, and the whole earth flourish as a garden of fatness. But for this dream to realize the proportions of a fair probability it is quite essential that chemistry should be well asleep.

The chief commodities bearing nitrogen are nitre or saltpetre (potassium or sodium nitrate) and ammonia. In Hindostan, the rich soil-mould, warm and alkaline, becomes thinly crusted with nitrate, which is gathered and brought to market as East India nitre. Gunpowder, gun-cotton and nitro-glycerine, as well as chemical products, are made with it. In the war of 1812, America was thrown upon her own sources for gunpowder material, and enough nitre was found in the cave deposits of the Southwestern States. Then France was hemmed in by hostile armies, and had neither nitre nor cave-deposits, but it was after the work of "Lavoisier of Immortal Memory," and the government put trust in chemistry. Berthollet and the rest soon justified the trust in the perfection of the "nitre plantations"—beds of farm-refuse with wood-ashes exposed to the air.

These products, soil-nitre and compost nitre, and the ammonia obtained as a by-product in the manufacture of illuminating gas, serve their several purposes in the arts and applications of man, but their limited quantities do not warrant their addition to the soil for the increased growth of food. Now, unlike these common supplies, the earth possesses a special resource for nitrogen in combination, anomalous in being fully mineralized and remarkable in being both concentrated and extensive, a chain of mines full of nitre. On the Pacific coast of South America, extending from the fourth to the fortieth degree of south latitude, about 2,400 miles along the slope of the Andes to the sea, in Bolivia, Peru, and part of Chili, there has been found a line of deposits of sodium nitrate, the "Peruvian nitre." The beds are of variable thickness, covered by one to ten yards' depth of earth and half-formed sandstone. The dry soil of most of this rainless country is pervaded, in some degree, with this deposit. The mummied remains of the old Peruvian people are embalmed with it by the earth in which they were buried; and its crystals glisten on those ghastly relics which were presented in the Peruvian department of the Centennial Exhibition, and those brought to this country by Dr. Steere. It has been estimated that in the province of Tarapaca, within fifty leagues square, the quantity of the nitre is not less than 63,000,000 tons. The appropriation of this vast resource has been taken up rather slowly, but has much increased for ten or twelve years past. Vessels laden with it go to the coasts of manufacturing countries. At Glasgow the works devoted to the production of ordinary saltpetre from the nitre of Peru extend over acres of ground. In 1868, 100,000,000 pounds were used in Great Britain. As yet, it has been applied to the nourishment of crops only to a limited extent. But this seems to be its chief destination, and for this use it lies in the earth, a vast mine of wealth, for the disposal of coming generations. When multiplied population puts the sustaining of the earth really to the test, this fund of sustenance on the Peruvian coast must come to outweigh in value the gold and silver mines of the California coast.

Of the several nitrogen compounds which nourish plants, ammonia yields the most immediately satisfactory results. And of this fertilizing material, some wellnigh mineralized deposits must be counted in with the earth's

possessions. To take note of these ammoniacal materials, we have again to begin at Peru. Standing on the shores which front the nitre-beds, and looking west upon the Pacific, there are seen, we are told, the low patches of the Cincha Islands—islands which shine with the whiteness of a powdery covering, a loose deposit of considerable depth. A cargo of this substance was first taken to London in 1840, stored and advertised for sale, and after a while thrown into the Thames. A second cargo was tried as a fertilizer by an English farmer, and found to give such marvelous results that the shipping company made good haste to contract with the Peruvian government for the entire deposit. This article, well known as guano, has held a settled value ever since its introduction, and, had it come into the hands of the alchemists, it would, very likely, have been presented as an elixir of vegetable life. Now, its worth is graded by analysis, and is indicated chiefly by the proportion of ammonia it contains.

The absence of rain will account, perhaps correctly, for the unusual retention of the soluble material characteristic of the guano of Peru; but the formation of the nitre-beds of that region is a problem in geological chemistry more difficult to determine. There are evidences of volcanic overflow and marine deposition, and the alkali in the compound may have originated in either of these or other sources, but neither the volcano nor the sea could furnish the nitrogen of the compound. If not from organic accumulations, we seem to be referred to the air as the source of nitrogen, and left to conjecture the conditions and forces which could bring elemental nitrogen into union in so great a quantity. Without pursuing these inquiries, it may be permitted to cite a fact which seems entitled to consideration in the case, namely, the conditions for an unusual overflow of atmospheric ammonia in this region. It is fed by perpetual trade-winds—winds coming from the south-east across a wide continent of soil that is rich to rankness, and warmed under a vertical sun. Coming from the Atlantic and saturated with water, these winds gather the exhalations of a continent, and then, shedding their water on the Andes, leave their ammonia (it may be supposed) to find its way by some means to the valleys of the western slope.

Again, these same mountain-valleys of Peru may claim to have given the world still another token of unexampled sources of nourishment, in the growth of the cinchona-tree, bearing the richest stock of nitrogenous bases in the vegetable world. It seems, indeed, more than a coincidence that this narrow, rainless, wind-nurtured slope of land should send to all the earth three such eminent resources as Peruvian nitre, Peruvian guano, and Peruvian bark.

Another of the materials adequate for no more than the needs of life is phosphorus. This element so far differs from nitrogen that it is not found uncombined in Nature, and if separated by art it immediately enters into combination on exposure to the air. It occurs chiefly in phosphate of lime, taken from the mineral kingdom by plants and also by animals. The hard part of bone is about nine-tenths phosphate, and phosphorus is an element of molecules organized into muscle and nerve.

The proportion of phosphates in the crust of the earth below organic remains is very slight, insufficient for the support of the higher forms of vegetable or animal life. It has been concentrated and gathered into the soil by the selective agency of the organic world, as it continues to be concentrated from the soil by each individual plant, and from vegetable products by each individual animal. Nearly all the phosphorus accessible on the planet has been the constituent of living bodies. Its proportion in the soil is a main factor in the growth of cereal grains. Already, and with the stretch of land to the westward, bone-earth and phosphatic guanos are well known in American markets. When phosphates fail at the root of the plant, grain fails at the mill; and when, from waste at the mill, phosphates fail in the bread, the bones and the teeth fail in growing bodies. The improvidence that leaves excretory phosphates to be washed away to the salt sea, farther from the reach of life than they were in the primitive rocks, is an improvidence that prepares an inheritance of poverty for after-generations. And the ruthlessness that permits the purveyors of food to sift phosphates from the food of men does its part to enfeeble the present generation.

There remains to notice another representative of the adequate resources, potassium. The statements made as to the supply of phosphorus, with some reservation, become true for potassium. Certain of the rocks contain a proportion of it, but from insolubility this is slowly available, and is insufficient for the needs of higher organic life. The soils contain more, because the organic world has gleaned for the soil. Potassa and soda are two alkalies which replace each other in the laboratory at the convenience of the chemist, but, in the choosing of the living cell, one of these is always taken and the other left. We get potassa free from soda in the ash of a tree which grew in a soil having more soda than potassa. From sea-water, containing near 200 parts of soda to one of potassa, the sea-weeds furnish an ash having two to twenty times more potassa than soda. From the blood of man, having ten to fifteen times more soda than potassa, the muscles obtain a composition of six or seven times more potassa than soda.

This gleaning is good proof of the value of more, and the evidence is confirmed by the application of potassa as a fertilizer. The stock of potassa—which is used somewhat in she arts—is derived mainly from the gatherings of the organic world. The ash-wagon takes up the savings of the hearth. In France the washings of sheep's-wool are saved, and 160 pounds of good potassium carbonate are obtained from a ton of the wool. In the pioneer life of this country, the housewives have burned corn-cobs and taken the ash for baking-powder, eighty per cent. potassium carbonate, and preferable to the "dietetic saleratus" now used. Should the ash of the entire corn-crops of the United States be taken without loss, it is estimated that over 100,000,000 pounds of potassium carbonate would be obtained. In the salt-beds of Stassfurt, Germany, there is a good proportion of potassa, and the use of this supply has been steadily increasing, both as material in manufactures and as a fertilizer.

XUM

At the present time, the market value of the resources of life engages little general attention. There is a narrow branch of commerce, wherein the prices-current of the three elemental materials which we have taken as "adequate resources" are the values constantly under calculation in daily business. In this guild, one sells nitrogen at thirty cents, another offers phosphoric acid at five cents; and all parties have a tacit understanding that the values of nitrogen, phosphoric acid and potassa, are to each other about as six, one and a half, and one, and that these are the only values to be considered. The technical terms of any profession or pursuit are jargon to the general ear. But hearing a man say that he "sold a hundred tons of rectified Peruvian at thirty-one cents for nitrogen, this morning," it is not so much as understood to what sort of business such jargon belongs.

Thinking of the multiplication of life and the waste of its resources, it seems that, in the time coming, the phrases that tell the rise and fall of value in commercial fertilizers may find some general recognition—may even have as much meaning for everybody as the terms of the gold market and the silver stocks.

It is only about a hundred years since man began to attain such definite knowledge of the components of matter as enables him to trace (we by no means say to understand) the transmutations of earth and air into tissues fit for life. Thirty-six years ago, Liebig commenced giving the people the first really systematic lessons upon the material resources of life. Seeing the value of a knowledge that goes below the surface of things, in 1852 he wrote his conviction that, "ere long, a knowledge of the principal truth of chemistry will be expected in the political œconomist and statesman, as it already is held indispensable to the manufacturer and physician." And, seeing the meanings and mysteries that cluster around the primary forms of matter, he wrote at another time: "It is not the mere practical utility of these truths which is of importance. Their influence upon mental culture is most beneficial; and the views acquired by knowledge of them enable the mind to trace, in the phenomena of Nature, proofs of an infinite wisdom—for the unfathomable depths of which language has no expression."

HYGIENE.

ON CATARRH.

BY DUDLEY S. REYNOLDS, M. D.

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The term Catarrh is one that has been generally applied to all forms of acute inflammation of the membranous lining of the air passages. Prof. G. B. Wood, in his "Practice of Medicine; devotes the last chapter of the first volume to the consideration of the subject of Catarrh, and he defines it as being "any acute inflammation of any of the mucous membranes of the body, not due to traumatic causes." As we usually see Catarrh in practice, Catarrh affecting the lining of the nose, the upper part of the throat, the Eustachain tube, and the cavity of the tympanum, the cases in the earlier stages of the disease rarely present themselves for treatment, except in that class of persons who suffer from catarrhal inflammation invading the middle ear.

It is a well known fact that the majority of persons who suffer with impairment of the hearing are effected with Catarrh, afflicted with an inflammation which is usually due to the inhalation of poisoned air. It was very clearly, unmistakably and undoubtedly established by Schonbein, in 1851, in his experiments with electricity, that powerful currents of electricity passing through the air decompose the oxygen, and develop a substance called ozone, which is said to be an allotropic form of oxygen. Ozone was demonstrated by Schonbein to be possessed of power to irritate the air passages sufficiently to develop the inflammatory processes of varying degrees of intensity, in proportion to the amount of ozone in the air and the duration of time occupied in the inhalation. It was noted on divers occasions, by astronomers, that whenever powerful currents of electricity occur, along with sudden elevations of temperature, there is general complaint from epidemic influenza, which is just another name for Catarrh.

We all remember what was called the epizootic, which prevailed in the winter of 1873 und 1874. The epizootic was a kind of Catarrh or influenza which affected the inferior animals. It is precisely the same cause which produces naso-pharyngeal Catarrh as we find it in our daily practice. The simplest form of Catarrh is that in which there is an afflux of all the circulating fluids in the membranes, with augmented secretion. That gives rise, of course, to considerable swelling and consequent obstruction to breathing, and we find that, whereas the nasal passages were perfectly free a few moments ago, that we are obliged to open our mouths to breathe. If you examine a case of that sort of Catarrh, you will find there is a very slight increase in the general redness of the membrane, without the destruction of

all its transparency, the blood vessels in the mucous membrane being clearly and distinctly visible, at the same time the venous trunks greatly distended and engorged. There is hyper-secretion of mucus, and along with this hyper-secretion of mucus is found, in many instances, an exudation of serum from the surface. There is a set of glands in the mucous membrane lining the nose known as acinous glands, which afford a secretion precisely identical in appearance and in chemical composition with tears. At the same time the lachrymal glands are irritated. There is a greatly increased secretion of tears, and when the Catarrh affects the nasal passages, extending up through the nasal duct into the lining of the eyelids, we have what is called coryza. That means acute Catarrh, affecting not only the nasal passages, but the conjunctival membrane as well.

We usually see cases of Catarrh that have existed for some time. They are not apt to present themselves for treatment until the disease has shown a disposition to linger, because Catarrh is one of those forms of disease that attack almost all animate nature. It attacks everybody that breathes air—every animal that breathes air is liable to acute Catarrh, and these attacks often disappear of themselves, without treatment.

Catarrhal inflammation, like any other localized inflammation, has a natural tendency to recover after running a definite course. But on account of the complicated character of the nasal passages, and the liability of the secretions to be retained in the ramifications, we find a steady disposition upon the part of this particular membrane or lining of the nose to suffer from chronic forms of disease—a special disposition upon the part of the catarrhal diseases to linger in the nasal passages. It sometimes fills the naso-pharyngeal space. It remains confined to that particular locality in many instances. for weeks, months, years, and from the naso-pharyngeal space it travels the Eustachian tube into the middle ear, and produces destructive changes in the wall of the tympanic cavity, before the presence of Catarrh is even suspected. With the aid of the rhinoscope, Catarrh limited to the naso-pharyngeal space may be discovered. The peculiar conditions of the membrane may be readily understood by bringing the surface directly into view. I say directly; I mean indirectly into view with the aid of the rhinoscope. In cases of Catarrh limited to the naso-pharyngeal space, attended with inflammation of the ear, it has been the customary practice to regard the disease as an affection of the ear, because the symptoms were not distressing until the hearing became impaired, and along with the beginning of this impairment in the hearing there was no pain in the ear. Pain, from what cause? From the swelling of the Eustachain tubes and limited supply of air in the tympanic cavity, and in that manner preventing the equal pressure of the air upon the drum membrane, giving rise to such tension as was sufficient to create great pain—great distress.

In some cases, where the quantity of air in the tympanic cavity from this source has been very limited, slight pressure upon the tragus forces the drum head backward, and the joint between the malleus and incus is dislo-

cated. This is an exceedingly painful condition, but may, if taken in time, be relieved, simply by inflating the middle ear with air. As to the treatment of Catarrh, of course it would be impossible for anybody to exhaust the subject, or even approach exhaustion.

It is to the treatment of chronic catarrhal affections of the lining of the nose, throat and ear, that we propose to confine our remarks this evening. Cases attended with hyper-secretion of mucus, partial loss of smell, dryness of the throat, the unpleasant sensation, if not positive pain, from attempts at swallowing, usually disclose upon inspection a double character of morbid change, a suppurative and proliferous inflammation, at the same time, in different parts of the same membrane; for instance, the lining of the inferior passages of the nose and the covering of the inferior turbinated bones yield an abundant secretion; perhaps the covering of the superior turbinated bones at the same time; but it frequently happens that the membrane covering the superior turbinated bones is perfectly dry, considerably swollen, very hard and indurated. At the same time the posterior wall of the naso-pharyngeal space presents the appearance of induration and dryness, and whatever mucus manages to flow over upon the surface of this membrane speedily dries in a hard, tough crust. It may be seen simply by making an inhalation with the mouth open; it may be seen upon the entire posterior naso-pharyngeal wall, down into the bucco-pharyngeal space. Cases of this kind are seen in every-day practice.

The greatest discrimination is necessary in the treatment of this double form of disease, the suppurative and proliferous form co-existing in different parts of the same membrane. In the first place, wherever the disposition is found to discharge tenacious substances, it becomes necessary to aid nature by some sort of medicament which has power to dissolve the fibrinous matter, and in that way facilitate its expulsion. For this salines, such as are usually employed as gargles, are serviceable, applied directly to the naso-pharyngeal space, with what is known as the posterior nasal syringe, which is a curved instrument having a bulbous point, with a great number of perforations in the bulbous tip. With the aid of this, any of the salines usually employed as gargles may be thrown into the naso-pharyngeal space, and in that way brought into contact with the largest portion of the membrane, and wash out the offensive matter. Now, if mucus accumulates in a crypt, if it is found in a cavity in any part of the body, it will rapidly degenerate into pus. The moment the requisite amount of moisture is withdrawn it dries. The dry quality is almost invariably due to the presence of pus. If it were not for pus, it would remain in the condition of ordinary mucus, and be expelled by being drawn up through the nose. Having cleansed the passages with a solution of bromide of potassium or muriate of ammonia—if the passage is very dry the bromide is not so good as the ammonia. Where these salts are not convenient, chloride of sodium may be used instead. It is not so good a defibrinizing agent, neither has it the power to stimulate secretion like the ammonia, nor has it the anæsthetic properties of bromide, yet it is

a very good substitute in the absence of the other two salts. Of course all these these things are to be kept in view in prescribing for cases of Catarrh. I have taken this typical form of chronic Catarrh as it presents itself for treatment, for obvious reasons.

After cleansing the passages with the posterior nasal syringe, which is an invaluable instrument, any instrument which has power to atomize or reduce fluid to the finest possible state of division may be used, and in that way you can medicate the whole of the nasal passages. Any instrument which has that power may be used for the purpose of medicating the naso-pharyngeal space and the little crypts in the nasal passages. I am in the habit of using, in preference to other instruments, what is known as "Holmes' Boston Perfumer." It has a metallic tip, and if properly cleansed, will not get out of order for a long time. It is the most serviceable instrument that I know of for the purpose of medicating the passage after cleansing with the posterior nasal syringe. A solution of the bromide of potassium, as a general thing, is the best, say from ten to forty grains of the salt to an ounce of water, and in proportion to the strength of the solution, the interval should be great; if the forty-grain solution be preferred, it should not be used more frequently than twice in one day—once in twelve hours. If the weaker solution be preferred—and that should depend upon the quantity of secretion—if the secretion is going on rapidly, if there is a large amount of matter secreted, the weaker solution applied frequently is the preferable method.

Now, after the disease has lasted some time, and the discharge somewhat dried up, as it were, leaving still an inflamed surface—preter-naturally dry, without any disposition to throw off its secretion—a solution of iodine and glycerine answers the purpose best. That is to be used, also, with the atomizer; to be preceded by the posterior nasal syringe loaded with some sort of cleansing fluid, to remove any of the inflammatory matters collected in any of the crypts or cavities of the nasal passages, or any where in the naso-pharyngeal space.

By the use of the speculum, introduced into the interior nares, and a strong light reflected from a concave mirror, the nasal fossæ may be explored, except in those cases where there is great swelling in the covering of the superior turbinated bones. It is precisely in this locality that catarrhs are likely to linger, and likely, always, to escape observation; and when you think the patient entirely relieved you find, to your surprise, that destruction of the bone has been going on—the superior turbinated bone perishing.

The iodine solution may vary from half a grain to five grains to the ounce; the five-grain solution being applicable to syphilitic subjects only. And there must always be a distinction between syphilitic ozæna and ordinary Catarrh; the ordinary Catarrh in the otherwise healthy subject never gives rise to any very offensive discharge. The decomposition of mucus may be very readily recognized by its odor, so may the destructive changes which take place in the osseous tissues, and in the other tissues of the body

affected with the syphilis, and what is known as strumous disease, which sometimes appears in the nose.

As a matter of observation, I have noticed that people who have Catarrh are prone to tie a knot in the corner of the handkerchief, or roll it around the end of the little finger and poke it up the nose for the purpose of removing incrusted matter, and in that way they abrade the surface, which creates a greater disposition upon the part of the secretion to adhere to this part and become dry and inspissated, and so the attempt to remove is repeated, and what was originally an abrasion gets to be a complete destruction of the whole membrane, with exposure of the bone, and exposure is likely to be followed by death of the bone, and in that way loss of the septum of the nose frequently results in ordinary cases of catarrh. In cases of syphilitic disease of the nose, attended with loss of the septum, or a portion of it, there is always great tumefaction of the surrounding parts. The marginal outlines are intensely red and considerably swollen, and this with the offensive character of the discharge, distinguishes the syphilitic from the traumatic sores.

Another form, called dry Catarrh, a proliferous inflammation with greatly diminished secretion, attacks persons given to excessive smoking. There is another form of Catarrh which is attended, not by dryness nor by any great moisture, but by swelling of the nasal membrane, with loss of the sense of smell, which is common to persons given to the habit of snuffing. There is the smoker's catarrh, the snuffer's catarrh, and epidemic catarrh.

In 1868, a German by the name of William Dumeyer, who kept a grocery at Market and Fourteenth streets, had a sore throat, and I wished to examine his larynx with the laryngoscope, but the fauces were so very sensitive to the approach of the mirror that I was obliged to use a solution of bromide of potassium, which I had learned was an efficient local anæsthetic. I gave Mr. Dumeyer a twenty-grain solution of bromide of potassium to be used as a gargle; that is the strength of the solution called the standard solution. It diminished the morbid sensibility of the fauces, and when I saw him again he said he did not need anything, he was well, and he wanted to settle his bill; he thought he was cured. I relate this to show you that the bromide destroys the sensibility of the membrane, and that suggested the application of it in the treatment of nasal catarrh. I formerly used this twenty-grain solution, which was regarded as the standard solution, for diminishing the morbid sensibility of the fauces, but I afterwards got into the habit of using a much stronger solution, even to saturation. I now sometimes, but rarely, use the saturated solution. Experience has convinced me that the weaker solution is better for general use with the atomizer. In many cases the catarrh is attended with the disagreeable symptom of the continued presence of mucus lying upon the soft palate and manifesting a disposition to find its way down into the throat. That class of cases is more common, and they are very troublesome sometimes. They may be prolonged indefinitely by the use of too strong applications—by too harsh a plan of treatment.

It has been, unfortunately, the practice of too many physicians to introduce brushes and mops, with caustic solutions, and in that way perpetuate the disease. I believe that the only true plan for the relief of catarrhal affections, like all other localized diseases, is to to search out the locality that that is chiefly affected, and direct the topical application to that point. In the class of cases under my consideration, where there are general symptoms of distress depending upon the presence of too much mucus lying upon the soft palate, and manifesting a disposition to flow down the throat, adhering to the uvula, a weak solution of bromide of potassium of five or ten grains is to be used. I employ what is known as Holmes' Boston Perfumer, held in such a manner that the fluid will find its way to the naso-pharyngeal space; and then snuffing it up the nose and hawking it out clears the surface entirely. Having cleansed both nostrils in this way, and having cleared the naso-pharyngeal space, a decoction of ordinary green tea, or a solution of five grains of carbolic acid and tannin to an ounce of water, or, as I generally prefer it, a mixture of equal parts of glycerine and water, is to be used immediately afterward, with the atomizer. This may be done three times every day; that is quite often enough. Cleanse the passages first with the bromide of potassium, which acts as a local anæsthetic, diminishing the morbid sensibility, and at the same time dissolving the fibrinous matter. Follow that with the decoction of green tea, or the solution of carbolic acid and tannin. (A favorite prescription is this: half a drachm each of carbolic acid and tannin, to be dissolved in three ounces each of glycerine and water. That is a mixture that I am in the habit of prescribing every day). It becomes necessary in many cases to make applications to the covering of the superior turbinated bones. These may consist of a half-drachm solution of carbolic acid to one ounce of water, or a half-drachm solution of iodine in glycerine, or a half-drachm solution of nitrate of silver to the ounce of water. These are the more common applications, and they are to be made with a brush or a little cotton-wool rolled upon the end of a probe, and the application is not to be repeated oftener than every other day. Catarrhal affections of the larynx generally call for local treatment. They are generally associated with bronchial Catarrh, which requires, in addition to local treatment, some constitutional measures. In the chronic forms of naso-pharyngeal Catarrh, constitutional measures are also required in a majority of instances. Where the affection invades the Eustachian tubes, creating an unpleasant noise in the ears that has been compared to the singing of grasshoppers, crickets, and steam escaping from a tea-kettle, the application should be made to the ear itself, and consist in filling the ear full of very warm water, and then have the head turned in a favorable position for the retention of the fluid, putting in a plug of cotton-wool to prevent the water escaping. Introduction of the Eustachain catheter may be practiced where there are evidently fluids in the tympanic cavity, or where the supply of air is deficient, and the patient cannot practice Valsalva's method, which consists in holding the mouth and nose shut, and blowing forcibly into the ears.

There should be no fluids blown through the catheter in this class of cases, and the use of the catheter should be restricted to the actual necessities of the patient for the removal of fluids from the tympanic cavity for the introduction of air.—*Med. and Surg. Reporter.*

TREATMENT OF HEADACHE.

A recent lecture by Prof. A. Smith, of the Bellevue Hospital Medical College, San Francisco, contains some valuable suggestions on the treatment of various forms of the Protean malady, headache. The following extracts will interest our professional readers:

A headache, when due to nervous disturbance, such as occurs in hysterical or excitable subjects, if associated with plethora, often yields to a saline cathartic. The most agreeable is the solution of citrate of magnesia, and should be given on an empty stomach. In addition, it is well to give one of the bromides combined with valerian. The following prescription I frequently use:

Sodii Bromidi.....ʒ vj.
Elix. valer. amm.....ʒ iv. M.

Sig. ʒ i. every hour until relieved.

If such nervous headache be associated with anæmia, after relieving the immediate attack with the bromide and valerian prescription, give iron, and give it for weeks, until there is a decided improvement in the patient's condition. Always give the iron after meals. In these anæmic cases it is often advisable to stimulate the heart's action. For this purpose I have found the following useful:

Amm. muriat.....ʒ ss.
Tinct. actææ racemos.....ʒ iij.
Aquæ.....ʒ iij. M.

Sig. ʒ ij. after meals in a wineglass of water.

It is important to attend to the general health of the patient. Remove all causes of excitement; encourage exercise in the open air; let the food be simple but nutritious; let the sleeping-room be large and well ventilated; in short, let the patient be surrounded by the best possible hygienic influences. These general remarks will apply to almost all forms of headache. I usually recognize two forms of sick-headache (so-called), the one neuralgic in character, as hemicrania and trifacial neuralgia, the other a dyspeptic headache. In the neuralgic variety the pain in the head precedes the nausea, while in the dyspeptic variety the pain in the head succeeds the dyspeptic symptoms. In the neuralgic, vomiting does not relieve the pain, while in the dyspeptic an emetic or laxative often removes the pain in the head by removing the cause. In addition to the treatment given in a previous lecture for neuralgic headache, which often occurs at intervals of a few

XUM

days, or a week or two, sometimes coming on at sunrise and disappearing at sunset, I have good results from the use of guarana, or Paullinia sorbilis, as it is sometimes called. I give it usually in powder, 15 grains every 15 minutes, until six doses have been taken. It is best given in a little sweetened water; and if six doses do not relieve, do not continue it; it will probably not relieve. It is well to give these powders in any headache (not malarial) of long standing and prone to return at certain intervals.

Dyspepsia is a frequent cause of headache.

If there is indigestible food in the stomach, and it has been there for some time, give an emetic, as mustard and warm water, or sulphate zinc grs. xv., and remove it. If there is evidence of indigestible food in the alimentary canal beyond the stomach, give gr. xx. of rhubarb and magnesia each, and remove it from the bowels. If the headache be frontal and the pain is located immediately over the eyes, give dilute nitro-muriatic acid in ten-drop doses, well diluted, after meals. If the pain is located about the roots of the hair, give an alkali before meals, as gr. xx. bicarbonate of soda or magnesia. The dyspeptic headache oftentimes is not confined to these regions, but spreads over the entire head. In such cases I combine an acid with an alkali, and add to these nux vomica, as in the following prescription:

Sod. bicarb. ..... ℥ iiss.
Ac. nitro-mur. dil. ..... ℥ ij.
Tinc. nuc. vom. ..... ℥ iss.
Syr. aurant. cort. ..... ℥ vj.
Aquæ, q. s. ad ..... ℥ vj. M.
Sig. ℥ ss. after meals in a wineglass of water.

If there be gastric pain, a mild counter-irritant, as a mustard plaster to the epigastrium, will often relieve the pain in the head as well as the pain in the stomach. If flatulence be a troublesome symptom, give the following:

Bismuth subcarb. ..... ℥ iss.
Tinct. nucis vom. ..... ℥ iss.
Tinc. card. co. ..... ℥ iv.
Spts. lav. comp. q. s. ad ..... ℥ iv. M.
Sig. ℥ ij. before meals in a wineglass of water.

If there be constipation, the following pill may be given, one in the morning:

Aloes pulv. ..... ℥ ss.
Ext. nuc. vom. ..... gr. v.
Ext. belladonnæ ..... gr. iv. M.
Div. in pil. No. xv.

In some forms of headache associated with stomach indigestion I have found small doses often repeated of tinct. nux vomica effectual. I give a single drop every fifteen minutes, and continue this two or three hours, if necessary. In other cases, where the headache comes on soon after a meal and seems to depend on delayed stomach digestion, large doses of pep-

sin are effectual. Give a half drachm of saccharated pepsin in a wineglass of sherry wine, t. i. d., and let it be taken during meals.

Cerebral congestion as a cause of headache may be divided into two varieties, active and passive. These claim almost directly opposite plans of treatment. In the active variety the patient should be kept in a darkened room, perfectly quiet, cold and evaporating lotions applied to the head. A saline cathartic may be given, and the following prescription:

℞ Sodii bromidi.....ʒ iiss.
Fld. ext. ergot.....ʒ iiss.
Syr. zinzib.....ʒ ss.
Aq. aurant. flor. q. s. ad.....ʒ iv. M.
Sig. ʒ ss. q. 2 h.

If the skin be hot and dry, and the pulse full and rapid, give Fleming's tinct. aconit. rad. gtt. ii. q. 2 h, until the heart's action is sensibly diminished. Sometimes a hot mustard foot-bath will give relief.

The passive congestive variety demands a different mode of treatment. In many cases this variety is found associated with cardiac disease, and most frequently where there is predominant dilation. Hypertrophy gives rise to the active variety. Improve the condition of the blood by the use of iron, quinine, bitter tonics, alcoholic stimulants, good food, and stimulate the heart's action by the use of the following:

Tinct. digitalis.....ʒ iij.
Spts. amm. aromat.....ʒ vj.
Spts. lavand. co.....ʒ iij.
Syr. simp. q. s. ad.....ʒ iij. M.
Sig. ʒ i. q. 4 h.

DENTIFRICES—GOOD AND BAD.

BY A. HOMER TREGO, D. D. S.

Dentifrice is derived from two words, *dens*, a tooth, and *fricane*, to rub. Why rub? Did nature intend teeth to be rubbed for some special purpose? No. It is because of the disobedience of nature's laws in diet, etc., that people are compelled to adopt artificial means for keeping their teeth clean. Keep clean? "Ah! there's the rub!"

Among the vast number of professional men of the past and present, there are but few who have arrived at a safe conclusion as regards the proper ingredients for dentifrices, or appreciate the danger of the general use of improper materials. The best authorities have found it highly important to denounce nearly all of the ingredients that have been and are now so universally prescribed and used.

Nearly all physicians and many dentists recommend castile soap or charcoal. All druggists use orris root, gum myrrh, orange peel, sugar, prepared chalk, soap, etc., etc., as the body of dentifrices. If they will inves-

tigate thoroughly they will find that they are very wrong. Soap, for instance, does not clean teeth. The same amount of friction with the brush and water will cleanse them better. The soap serves as a lubricator, causing the brush to glide smoothly over the teeth and gums; hence its popularity. No reasonable amount of scrubbing will remove the viscid effects of the soap from the mouth; it remains there as an irritant to the soft parts of the teeth and mucous membrane, and as an absorbent of calculi, forming a base for tartar, gangrene and decay. Fine soaps are composed of olive oil and soda. The olive oil is certainly not a detersive, and the soda certainly is a dangerous alkali. Mottled soaps are made so by use of green vitriol and sulphureted ley. A still greater danger is in store for those who use soap as a dentifrice. The cheaper grades are made of cheap ley and common oil, or more frequently of animal fat, and very often of animals that die of disease or poison, in and near large cities where the soap factories exist. Bad cases of diseased mouth are frequent subjects in the colleges—directly traceable to the use of soap. I have numerous cases of loose teeth—where every tooth seems to be lying around in a bed of ulceration. Ask the patients what they have used as dentifrices and the reply is soap, prescribed by Dr. Pillgarlick.

The most advertised tooth-wash extant is popular because it produces a froth in the mouth. It is composed of water, rum and soap bark (*quillaya saponaria*). The active principle of this bark is an acrid vegetable alkali. Well-known chemists and dentists who have tested it, pronounce it positively injurious, especially when used any length of time by delicate ladies and children. Rum and myrrh, as a mouth-wash, produce a froth. Myrrh is bad on account of being too pungent, and depositing a resinous precipitation about the teeth and gums. Orris root, orange peel, sugar, etc., are used only to add bulk and flavor, and on account of their pasty qualities are certain to leave deposits that form a dangerous nucleus for tartar—by absorbing acid and gas,

Charcoal, next after soap, is is the greatest nuisance any intelligent professional ever persisted in prescribing. All they claim for it is that it scours dirty teeth, and, being carbon, it absorbs the acids. Every patient I have seen that continued its use over a year, has scoured his teeth and gums almost to ruination. Microscopical examination shows every atom to be a sharpened flake that scratches, like a diamond, everything it comes in contact with. (It cannot be reduced to an impalpable powder.) These flakes are forced in the interstices of the teeth and under the gingival margins of the gums, where they retain acids, and transmit them to sensitive parts which they would not otherwise reach. When charcoal has been used a short time, blue lines may be seen under the margin of the gums. After continued use the necks of the teeth become exposed and sensitive and loose almost beyond remedy.

All gritty dentifrices have the same objectionable qualities. Salt is both acid and alkali, and has no merit as a *fricane.*

All acids and alkalis, like the aforementioned ingredients, are absolutely dangerous in a majority of cases. Like stimulating beverages, they may not show their bad effects in a day or week, but in a few months or years they become uncompromising destroyers. Borax and alum, for their astringent qualities, may be used temporarily in certain aphthous affections and mercurial sore mouth. They should be mixed with honey, sugar or sage.

For everybody's daily use, for keeping the teeth clean and the gums healthy, a mild astringent, antacid, antalkaline, styptic wash is decidedly the most pleasant, cheapest and only safe dentifrice known to the leaders of the profession. If properly prepared it dissolves the mucous calculi and other injurious secretions, and all can be readily removed from the mouth by the gentle use of a soft brush and rinsing with water.

In cases of predisposition to formation of tartar—from viscid secretions arising from disordered stomach—precipitated chalk should be used once a day, in connection with the wash. Always cleanse well between and on the inner sides of the teeth. Always use well-made brushes—those having plenty of soft bristles or badger's hair. For children, very small and soft brushes. Children's first teeth should be kept clean. They should be taught to brush their teeth every time they wash and comb their hair. "Cleanliness is next to Godliness," and the neglect of cleanliness is the direct cause of so much "toothcarpentering" being required. "Delays are dangerous and expensive."

POPULAR FALLACIES.

Night air and damp weather are held in great horror by multitudes of persons who are sickly or of weak constitutions; consequently, by avoiding the night air, and damp weather, and changeable weather, and weather that is considered too hot or too cold, they are kept within doors the much largest portion of their time, and as a matter of course continue invalids, more and more ripening for the grave every hour; the reason is, they are breathing an impure atmosphere nineteen-twentieths of their whole existence.

As nothing can wash us clean but pure water, so nothing can cleanse the blood, nothing can make health-giving blood, but the agency of pure air. So great is the tendency of the blood to become impure in consequence of waste and useless matters mixing with it as it passes through the body, that it requires a hogshead of air every hour of our lives to unload it of these impurities; but in proportion as this air in vitiated, in such proportion does it infallibly fail to relieve the blood of these impurities, and impure blood is the foundation of all disease. The great fact that those who are out of doors most, summer and winter, day and night, rain or shine, have the best health the world over, does of itself falsify the general impression that night air or any other out-door air is unhealthy as compared with in-door air at the same time.

Air is the great necessity of life; so much so, that if deprived of it for a

moment, we perish; and so constant is the necessity of the blood for contact with the atmosphere, that every drop in the body is exposed to the air through the medium of the lungs every two minutes and a half of our existence.

Whatever may be the impurity of the out-door air of any locality, the indoor air of that locality is still more impure, because of the dust and decaying and odoriferous matters which are found in all dwellings. Besides, how can the in-door air be more healthy than the out-door air, other things being equal, when the dwelling is supplied with air from without?

To this very general law there is one exception, which it is of the highest importance to note. When the days are hot, and the nights cool, there are periods of time within each twenty-four hours, when it is safest to be in-doors, with doors and windows closed; that is to say, for the hour or two including sunrise and sunset, because about sunset the air cools, and the vapors which the heats of the day have caused to ascend far above us, condense and settle near the surface of the earth, so as to be breathed by the inhabitants: as the night grows colder these vapors sink lower, and are within a foot or two of the earth, so they are not breathed. As the sun rises, these same vapors are warmed, and begin to ascend, to be breathed again, but as the air becomes warmer, they are carried so far above our heads as to innocuous. Thus it is that the old citizens of Charleston, S. C., remember, that while it was considered important to live in the country during the summer, the common observation of the people originated the custom of riding into town, not in the cool of the evening or of the morning, but in the middle of the day. They did not understand the philosophy, but they observed the fact that those who came to the city at mid-day remained well, while those who did so early or late suffered from it.

All strangers at Rome are cautioned not to cross the Pontine marshes after the heat of the day is over. Sixteen of a ship's crew, touching at one of the West India islands, slept on shore several nights, and thirteen of them died of yellow fever in a few days, while of two hundred and eighty, who were freely ashore during the day, not a single case of illness occurred. The marshes above named are crossed in six or eight hours, and many travelers who do it in the night are attacked with mortal fevers. This does, at first sight, seem to indicate that night air is unwholesome, at least in the localities of virulent malarias, but there is no direct proof that the air about sunrise and sunset is not that which is productive of the mischief.

For the sake of eliciting the observations of intelligent men, we present our theory on this subject.

A person might cross these marshes with impunity, who would set out on his journey an hour or two after sundown, and finish it an hour or two before sun-up, especially if he began that journey on a hearty meal, because, in this way, he would be traveling in the cool of the night, which coolness keeps the malaria so near the surface of the earth as to prevent its being breathed to a hurtful extent.

But if it is deadly to sleep out of doors all night in a malarial locality, would it be necessarily fatal to sleep in a house in such a locality? It would not. It would be safer to sleep in the house, especially if the windows and doors were closed. The reason is, that the house has been warmed during the day, and if kept closed, it remains much warmer during the night indoors than it is outdoors; consequently, the malaria is kept by this warmth so high above the head, and so rarified, as to be comparatively harmless. This may seem to some too nice a distinction altogether, but it will be found throughout the world of Nature that the works of the Almighty are most strikingly beautiful in their *minutiæ*, and these *minutiæ* are the foundation of His mightiest manifestations.

Thus it is, too, that what we call fever and ague might be banished from the country as a general disease, if two things were done. 1. Have a fire kindled every morning at day-light, from spring to fall in the family room, to which all the family should repair from their chambers, and there remain until breakfast is taken. 2. Let a fire be kindled in the family room a short time before sundown; let every member of the family repair to it, and there remain until supper is taken.

In both cases, ths philosophy of the course marked out consists in two things. *First.* The fire rarifies the malaria and causes it to ascend above the breathing point. *Second.* The food taken into the stomach creates an activity of circulation which repels disease.—*Hall's Journal of Health.*

HYGIENE OF THE EYES

A series of questions touching the care of the eyes were recently submitted to Dr. E. G. Loring, Jr., by the Medico-Legal Society of New York. Dr. Loring replied in a paper which has since been published in the *Medical Record.* To the first question—namely, whether bad air has any direct effect on the sight?—the author replies that vitiated air has a specially irritating influence on the mucous membrane of the eye; and that bad air, as a primal cause, may set in train morbid processes which not only will affect the working capacity and integrity of the organ, but may even lead to its total destruction. The second question was, whether size and quality of type would cause disease of the eye? According to Dr. Loring, the smallest print which a normal eye can readily recognize at at a distance of one foot is about one-fiftieth of an inch, and at eighteen inches is about one thirty-second of an inch. The normal eye should not be subjected for any length of time to a type smaller than *this size*, or one-sixteenth of an inch, and it would be better, after middle-life, to employ a type even a little larger than this; but the employment of spectacles removes in a great degree the necessity of a larger type with advancing years. The finer the type the closes the book has to be held to the eye, and the greater the demand on the focaliz-

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ing power and the muscles that bring both eyes to bear at once upon the print. On the other hand, too coarse type is wearisome to the eye, requiring more exertions of the muscles that govern the movements of the eyes. The distance between the lines should be about one-eighth inch; nearer than this is apt to be confusing, farther apart is also confusing. Heavy-faced type is preferable to light-faced. An almost imperceptible yellow tint in the paper, "natural tint," is very desirable; pure white paper, especially if it has a metallic lustre with bluish tinge, should not be employed. The paper should be thick enough to be transparent, should have a close, fine texture, and be free from sponginess. To the third question—whether too long and constrained attention to one object, without rest or variety, will cause eye-disease?—Dr. Loring replies affirmatively, and assigns the physiological reasons. Finally, he was asked whether the angle at which the light strikes the eye is important? He replies that the light should not come directly in front; neither should it come directly behind. It should not come from the right side, because, in writing, the shadow of the hand falls across the page; and a moving shadow over a lighted surface not only reduces the quantity of light and leads to a stooping position, but it is also more more annoying to the eye than a uniform reduction of the illumination of even a greater degree. The best direction for the light to come is from the left-hand side, and from rather above than below the level of the hand.—*Popular Science Monthly.*

HIGH TEMPERATURE AND BOWEL-COMPLAINTS.

Dr. N. S. Davis, in a "Report on Clinical and Meteorological Records," communicated to the American Medical Association, an abstract of which we find in the *Medical Record*, reaches the conclusion that the bowel affections, so characteristic of this temperate climate, begin invariably with the first week of continuous high temperature, and that every subequent occurrence of several days and nights of continuous high temperature causes new attacks to be increased in number throughout the month of July, less in August, and still less in September; that it is not simply the extreme of heat, but its duration, which determines the number of attacks; that this continuous heat, to be efficient in producing these affections, must follow a protracted season of cold; and that, if we compare these deductions directly with statistics of mortality, we shall find them to conform in every particular in that the high rate of mortality follows exactly the same line. That fact was regarded as one of great importance in connection with sanitary measures which were to be adopted for the protection of life in infants; preventive measures must strike with the first week of high temperature. These conclusions were corroborated by quotations from mortality-tables.—*Popular Science Monthly.*

NATURAL HISTORY.

ENTOMOLOGY.

BY PROF. F. H. SNOW, KANSAS STATE UNIVERSITY, LAWRENCE.

Entomology, or the science of insects, has even in recent times been regarded with disfavor. Not more than forty years ago the distinguished M. Renous was arrested and brought to trial by the authorities of St. Fernando in Chili, upon the charge of witchcraft, because he kept certain caterpillars which turned into butterflies. Nearer home within the past three years, an essayist before the Kansas State Teachers' Association denounced the waste of time by young people in the pursuit of butterflies. During my own frequent excursions with long-handled net, cyanide-bottle, empty cigar-box and other collecting apparatus, I invariably encountered the astonished stare and incredulous smile of passers-by, who often seem to doubt the sanity of a man who deliberately devotes his time to "catching bugs." But it is not necessary before an intelligent audience to defend a science which has so intimate a connection with the professions of agriculture and horticulture.

This science embraces a broader field than any other department of Zoology. This is made clear when we consider that of the 250,000 living species included in the animal kingdom about 200,000 species or four-fifths of the whole belong to the single class of insects. The history of this immense array of living creatures is yet to be written. Comparatively little is known of the transformations and habits of the vast majority of insects.

A complete work on Entomology, which should devote but a single page to each species would occupy nearly 300 volumes of the size of our American Cyclopædia. Yet the celebrated Straus Durckheim devoted seven years to the study of a single species of beetle and embodied his results in a volume which will constitute a perpetual monument to the genius of its author.

Of the 200,000 species of insects thus far discovered upon our globe, some 50,000 are found in the United States, and it may be safely estimated that 10,000 species occur within the boundaries of the State of Kansas.

The impression exists among many that all insects are injurious, and the best friends of the farmer and fruit grower are too often destroyed by those whose zeal would be profitably mingled with knowledge. Of the *benefits* conferred by insects we may note the following:

1. The removal of offensive material from the face of the globe. Whole families of insects act as scavengers to purify the earth and air. Let an animal die and the mimic beetles and the skin beetles remove its dormal covering, thus allowing the army of flies to deposit their eggs within the flesh. Within five days all the softer material is removed and still other species attack the more obdurate portions of the carcass.

2. The destruction of noxious insects. Some of the largest families of beetles are exclusively carnivorous and destroy multitudes of insect pests. Such are the tiger beetles, the predaceous ground beetles and the lady-birds. The large green beetle known as the caterpillar hunter, eagerly devours the maple worm, the army worm, the canker worm and the locust. The lady-birds consume vast numbers of plant lice. I have bred three species of flies from the maggots which proved so destructive to our recent pest—the hateful locust. Nearly all injurious insects have some Ichneumon fly, or other parasite to reduce their otherwise overwhelming numbers.

3. The furnishing of food to other animals. Here we may cite the May fly (*Palingenia bilineati*) which has occurred in the winged condition along our rivers for some time, and both in the larva and in the perfect state supplies our fishes with abundant and wholesome food.

4. The furnishing to man of valuable products useful as medicines, dyes, wax, honey, silk, etc., etc. It is refreshing to note in these latter discouraging but now brightening days, that the silk raising experiment of Franklin county has proved so complete a success, and that the eggs of the silk worm raised in Kansas are the best that the world affords. Now that Kansas eclipses Japan in the French markets for this commodity, the propriety of extending the culture of the silk worm in our favorable climate need not be urged upon your consideration.

It is well known to entomologists that no less than fifty species of insects prey upon grains and grasses, thirty on garden vegetables, fifty on the grape-vine, seventy-five on the apple, an equal number upon the pear, peach and plum, fifty on the oak, seventy-five on the walnut, and one hundred on the pine.

It becomes therefore an important question how we may protect ourselves from insect ravages. I would first suggest private measures. Every owner of a vineyard, orchard or farm should be on the alert to discover and destroy these noxious insects upon their first appearance. A species may exist in comparatively small numbers one season and be destroyed completely and with ease, but if left unmolested on account of its occasioning no apparent damage it will multiply almost incredibly, and the next season appear in overpowering numbers, annihilating its food plant. This was the case last month in a vineyard in which the fruit, foliage and young canes, which had been spared by the locusts, were entirely destroyed by the caterpillars of the beautiful moth known as the Eightspotted Forester. This insect appeared in the same vineyard last year without attracting much attention, and might have been exterminated with little trouble. Let me here commend to your notice the plan adopted by N. P, Deming, who found his orchard this year overwhelmingly attacked by that worst enemy of our apple trees—the Flat Headed Borer. He offered his son a reward of so much per hundred for all the beetles he would collect. I consider the plan of defence by destroying the insects as far as preferable to the protection of the trees by washes. The best of washes will soon be washed away by the rains

or lose its strength under the summer sun, and even if made effectual by frequent renewal, the beetles are left alive to visit other orchards or to devastate the maples and oaks of our roadsides and forests. This thousand beetle females, and if we suppose each female to produce fifty eggs we see that by their destruction 25,000 borers have been "nipped in the bud."

5. The fertilization of plants. It is one of the wonderful facts of natural history that the two great kingdoms of plants and animals are so closely related that each is essential to the existence of the other. That animals could not live without plants, since from these they directly or indirectly derive their sustenance, is really understood. But that plants could not live without animals is a proposition which needs some explanation. Some plants, like the common squash, are so constructed that their staminate and pistillate blossoms are separate from each other. In such cases it is evident that the pollen must be conveyed from the stamens to the pistils by some external agency. This operation, though in some cases performed by the wind, is regularly accomplished by insects, which, in the repeated act of taking honey, convey the pollen from flower to flower, and thus secure the fertalization of the ovules. Other plants have perfect blossoms, containing both stamens and pistils, so that it would seem that there would be no need of insect agency to secure the growth of the seed. But it is found that when these perfect flowers are artificially guarded from the approach of insects, either no seed at all, or else very scanty and imperfect seed are produced. If a portion of a clover field be covered with gauze during the period of bloom so that the humble-bees can obtain no access to the blossoms, no seed whatever will be produced. Yet each clover head has an abundance of stamens and pistils. I observed the maple trees in front of my house (*Acer dasycarpum*) when in bloom in early spring. One tree had stamens only; the next tree had perfect blossoms, but the pistils were fully developed and ready to receive pollen while their own stamens were still in a rudimentary condition, and the hive bees were conveying the pollen from the first tree to the second. Two or three days later, when the pistils of the second tree had wilted, its stamens had reached maturity, and the bees were conveying their pollen to the pistils of a third tree. Thus flowers do not furnish honey to insects from purely disinterested motives, but with sweet allurements entice them to perform an act essential to the very existence of the vegetable kingdom.

6. The last benefit derived from insects to which I would briefly invite your attention is the restraining of vegetation within the proper bounds.

There is no doubt that in a state of nature the kingdom of plants would suffer great deterioriation if the number of individuals was not kept within reasonable limits by insect depredations. By this agency a disastrous crowding of vegetable growth is in a great measure prevented.

We now pass on to consider the large class of injurious insects. It has been shown that in a natural condition of things, destructive insects have their proper and useful position. But man interferes with the primitive

relations of the world of nature, and for his own good establishes a new order of things. Instead of allowing the grapevines and fruit trees to remain in the forest, separated from one another and associated with hundreds of other species of vines and trees, he for his own convenience and comfort gathers the vines by themselves into vineyards, and the trees by themselves into orchards. He then improves the quality of the fruit by cultivation. But these altered conditions furnish vastly improved facilities for the multiplication of the many species of insects which find their homes upon or within the vines and trees. What were formerly useful pruners and restrainers of an over luxuriant vegetation, now become ruthless destroyers, and man must exercise his keenest intelligence to protect himself from ruin. The annual damage inflicted upon crops and fruits in the United States has been variously estimated from $300,000,000 to $500,000,000. An equal destruction of property by an army of invasion would cause our national government to expend millions of dollars in defence. The loss occasioned by the ravages of the Rocky Mountain or Hateful Locust during the past year, cannot fall below $100,000,000. Yet the total amount annually expended for the repression of insect foes by congress and all our state legislatuers combined does not exceed $18,000.

I would therefore suggest, under the head of public measures: 1st. Legislation to compel every man to keep his grounds free from insect pests. No one has a right to foster noxious agencies for the destruction of his neighbors' crops and fruit. 2. A bounty might be offered in certain cases by the county, state or general government for the capture of injurious insects. A reward of twenty-five cents a bushel for locusts during our recent visitation by this scourge would doubtless have prevented a large portion of the damage inflicted. Such a reward would certainly be as legitimate as the customary bounty for gopher skins. 3. The introduction of parasites should be undertaken by the general government. Many of our most destructive insects have been introduced from Europe. In the old country they have many parasites to keep them in check, but as yet few of these parasites have made their way to this country, so that our foreign foes have proved most destructive on account of the absence of their natural checks. That the plan proposed is a feasible one has been proved by Dr. Le Baron, the Illinois State Entomologist, who has successfully introduced into northern Illinois a parasite upon the apple bark louse. 4. Every State in the Union should employ a competent man as State Entomologist, who should give his whole time to the work of investigating the habits of insects, and disseminating information among the people. Messrs. Fitch, Riley and Le Baron have saved millions of dollars to the great States of New York, Missouri and Illinois, by their indefatigable entomological labors. The salaries paid to these men have been a thousand fold returned to the states employing them. 5. The legal protection of insectivorous birds. A commission should be appointed to determine what birds should receive this protection. 6. The plan proposed for the appointment of a national commission for the prevention of

national calamities occasioned by insects is worthy of endorsement by every farmer and fruit-grower in the land. The petition to congress for such commission should receive universal signature. 7. I would finally suggest that if our people were more generally familiar with the subject of entomology and were able to distinguish between the beneficial and injurious insects, our universal enemies would be more intelligently and effectually resisted. To this end I would earnestly recommend the introduction into our schools of the elements of this extremely practical science. Independently of the educational advantages of natural history studies, the "practical" value of a knowlege of plants and insects, should forcibly commend botany and entomology to these who determine the course of training in our common schools.

THE HONEY-MAKING ANT OF TEXAS AND NEW MEXICO.

(*Myrmecocystus Mexicanus*, Westwood.)

The natural history of this very curious species is so little known that the preservation of every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations gleaned from Captain W. B. Fleeson of San Francisco, who has recently had an opportunity of studying the aunts in their native haunts, may, it is hoped, be not without interest. The community appears to consist of three different kinds of ants, probably of two separate genera, whose offices in the general order of the nest seems to be entirely apart from each other, and who perform the labor alotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow working ants of two kinds, one of which, of a pale golden yellow color, about one-third of an inch in length, acts as nursers and feeders of the honey-making kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey-secreting workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color, and with very formidable mandibles. For the purpose of better understanding the doings of this strange community, we will designate them as follows:

No. 1—Yellow workers; nursers and feeders. No. 2—Yellow workers, honey-makers. No. 3—Black workers; guards and purveyors. The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nest of most other ants, however, the surface of the soil is usually undisturbed, and, but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subjected to no disturbance, and not pulverized and rendered loose

as is the case with the majority of the species. The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one corps moving from the south-east to the south-west corner of the fortification, while the others proceed in the opposite direction. In most of the nests examined by Captain Fleeson the direction of the nest was usually towards the north; the east, west and the northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment a number of guards leave their station in the line and sally forth to face the intruder, raising themselves upon their hind tarsi, and moving their somewhat formidable mandibles to and fro as if in defiance of their foe. Spiders, wasps, beetles, and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerers marching back to assume their places in the line of defense; their object in the destruction of other insects being the protection of their encampment, and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing north-east, and carrying in their mouths flowers and fragments of aromatic leaves, which they deposit in the centre of the square. On the west side of the encampment there is a hole leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole near to the south-east corner of the square is the only other means by which the interior can be reached, and down this aperture the flowers gathered by the black workers are carried from the heap in the centre of the square, by a number of smaller yellow workers (No. 1), who with their weaker frames and less developed mouth-organs, seem adapted for the gentler offices of nurses for the colony within. It is remarkable that no black ant is ever seen upon one line, and no yellow one ever approaches the other's line, each keeping his own separate station and following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrance, a small excavation is reached, across which is spread in the form of a spider's web, a net-work of squares spun by the insects, the squares being about one-quarter inch across, and the ends of the web fastened firmly to the earth of the sides of the hollow space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the nest. Indeed, it would be difficult for them to do so, as their abdomens are so swollen out by the honey which

they contain as to render locomotion a task of difficulty, if not to make it utterly impossible. The workers (No. 1) provide them with a constant supply of flowers and pollen, which by a process analogous to that of the bee, they convert into honey. The fact that the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation; indeed, with reference to many of the habits of these creatures, we are at present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts are yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit of the inhabitants in general, and then proceed to distil more. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighborhood of Santa Fe, N. M., in which district the observations of Captain Fleeson were made —*Henry Edwards in London Journal of Applied Science.*

THE BRUSH AND COMB OF THE HYMENOPTERA.

Bees have always been noted for cleanliness of person. It appears to be necessary for them to take particular care in this respect of their antennæ. Any one who has observed bees and wasps, must have noticed how much time they spend in cleaning these mysterious organs; and, perhaps, will remember the singular, almost human-like motions—the careful, dexterous strokes in one direction, with which the work is done. One of the fore legs is thrown over the antenna of the same side of the head; the antenna is caught at a certain point of the leg, which at the proper instant is here slightly bent for the purpose; and then, with an outward and downward sweep, the antenna is drawn from its base towards its tip through this bend.

A little attention shows why the antenna is caught at a certain bend of the leg. There is a special apparatus at that particular spot, admirably adapted for the purpose. At the junction of the tibia and the tarsus is the apparatus mentioned. It comprises—first, a specialized spine, hinged, movable, brush-like, and projecting from the inner side of the leg; second, a deeply-cut, semi-circular notch, in the upper part of the first tarsal joint, fringed with a row of closely set teeth, like a curved comb. When the leg is bent towards the body at this point, the comb is accurately opposed to the brush, leaving a circular opening, through which the antenna is drawn, and neatly cleansed at every part of its circumference.

This developed spine is mentioned as a brush, because of its graceful,

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brush-like form in either species of the hymenoptera. In the honey bee it appears to have no especial fringe of bristles, but is membranous, thin, of irregular outline, and doubled, like a leaf with the edges curled towards each other, having the concave side opposed to the leg. The stout spines above and below the notch, are a few of the usual spines which abound on this part of the leg. The teeth of the comb are seen in a regular curve, fringing the inner contour of the notch, and pointing towards the centre of the opening.

The brush on the fore leg of a winged red ant well deserves the name. Its back, or convex side, is armed towards the tip with finely pointed projections; and its concave side, from the tip to a large pointed process in the neighborhood of the base, or for about two-thirds of its length, is fringed with long, closely set teeth, which must render the brush an admirable duster. There is no deep notch in the tarsus, as with the honey bee, but a decided curve, with a gently sweeping and extended comb.

The brush on the fore leg of the blue mud wasp (*Pelopæus cæruleus*) is large, prominent, and of strikingly graceful form, as might be expected from the characteristics of this species. The teeth of the brushing edge, opposed to the leg, begin quite near the base, and extend downwards in a prominent reversed curve to a large, pointed process, and are then succeeded by a close row of sharp spines to the tip. The teeth of the comb are set in a notch, in the upper part of the tarsus, very much like that of the honey bee, only not cut in with such a deep, short curve.

The white-horned horn-tail (*Urocerus albicornis*) is one of the largest of the hymenoptera. It has long, narrow wings, and a long, cylindrical body, giving it somewhat the appearance of a dragon-fly; but it is much more sluggish in its movements than the latter insect. The female is armed with a long, slender borer, hinged to the middle of the under side of the abdomen, with which she bores the trunk of the pine tree to deposit her eggs. In this insect the brush and comb would hardly be recognized, as they have been strangely transformed into what may be called a thumb and knives. The thumb is hinged to the lower end of the tibia, in the usual position of the brush. It is nearly straight, fleshy, cylindrical and ends in a slightly curved spinous tip. Instead of the comb, found on most other members of the great family of the hymenoptera, there is a long row of curious appendages, gradually increasing in size as they extend downwards, and set on the inner side of the enormously lengthened first tarsal joint. They rise from a somewhat bulbous base, continue for about one-third of their length with a cylindrical trunk, and then suddenly expand in an extremely thin and transparent blade.

They would evidently have formed a good model for the flint knives made by our progenitors of the "stone age." The back of each knife is directed downwards; while the cutting edge, taking a broad sweep from the handle to the extreme point, is directed upwards towards the thumb. In the individuals which I have examined, the thin upper edge of many of

the knives appeared split and ragged, reminding one of the broken and frayed wings of the worker honey bee, after she has passed a few weeks in the severe labors of the honey harvest.—*American Journal of Microscopy.*

THE RIBBON FISH.

Frank Buckland, in a recent letter to *Land and Water*, says: "I have received, through the kindness of a correspondent at Nice, a very interesting and remarkable specimen of a ribbon fish. I make him out to be a *regalicus*. I have never before seen one of these most curious fishes in the flesh. It measures five feet, is about a quarter of an inch thick, and is of a silvery hue, not unlike the color of the 'silver-hair tail.' Upon the top of the head there are filaments, which, when stretched to their full, are about eight inches long. The head is very remarkable; altogether it is not unlike the shortened head of a horse. The mouth is prehensile, and so peculiarly formed that it is quite worthy of a figure; the eyes are very large and circular; the iris of a lustrous silver color. Behind the head the body is two and a half inches deep, in the middle two inches, at the tail a quarter of an inch. When held up to the light it is almost transparent; the vertebræ can with difficulty be seen, but with the movement of the fingers each vertebra will give a slight crack at the junction with its neighbor. The vertebræ are longest and thickest towards the tail end, at which there are sharp spines. It is covered everywhere with a fine silvery powder, which readily comes off in the hand. It has a crest of about an inch in height, which runs down the whole of the back. The rays forming the crest are united to double pillars of very slender bone. In substance it is very delicate, and begins to dry and harden almost immediately on exposure to the air.

"I cannot find much about this fish in any of my books. This family of ribbon-shape form consists of seven genera and twenty-six species. Mr. Swainson remarks of it as follows:

"'It contains the most singular and extraordinary fishes in creation. The form of the body, when compared to fishes better known, is much like that of an eel, the length of the body being in the same proportion to the breadth; but then it is generally so much compressed that these creatures have acquired the popular name of ribbon fish, lath, or deal fish. The body, indeed, is often not thicker, except in the middle, than is a sword, and being covered with the richest silver, and of great length, the undulating motions of these fishes in the sea must be resplendent and beautiful beyond measure. But the wonders of the mighty deep are almost hidden from the eye of man. These meteoric silver-coated fishes appear to live in the greatest depths, and it is only at long intervals, and after a succession of tempests, that a solitary individual is cast upon the shore with its delicate body torn

and mutilated by the elements on the rocks, so that with few exceptions they are scarcely to be regarded as edible fish.'

"According to this authority, the Mediterranean has hitherto produced the largest proportion of the family, but it is distributed from the arctic regions to the sunny shores of India, so that probably a tithe has not yet been discovered."

BOOK REVIEWS.

BALDWIN'S PREHISTORIC NATIONS.

BY PROF. G. C. BROADHEAD.

All knowledge of mankind previous to our written histories is involved in obscurity, and by many is considered mythical. But industry and persevering research have availed much. The work before us by J. D. Baldwin and published by the Harpers, contains an apparent clearly connected train of what at first appearance is all mystery. The oldest civilization is traced to the ancient Cushites. From them, in direct descent, is traced the Chaldeans, and through them the Babylonians a little later. Another colony passed northwardly and settled Phœnicia. Another passed eastwardly and settled India, and they are now represented by certain inhabitants of the Dekhan. Still progressing eastwardly they may have penetrated Malacca. From Southern India they took possession of Ceylon, and there they flourished for many ages as a powerful and intelligent nation. Westwardly they crossed over and founded the ancient Kingdom of Egypt, of which we know so little. From Lower Egypt they ruled supreme in Upper Egypt and Abyssinia, and thence extended their settlements across the whole of Northern Africa.

The Phœnicians, long before Rome knew anything of civilization or of letters, sailed in ships to India, to Southern Africa and around Africa, founded the Empire of Carthage, built cities in Spain, brought tin from England and amber from the Baltic.

The Romans and Grecians, in their blind selfishness and jealousy, destroyed the records and evidences of culture of the conquered nations. The Phœnicians and Egyptians had their libraries, but where are they now? Destroyed, and mainly by the conquering nations. We only possess a few engravings on stone; yet Arabia and Phœnicia furnished the alphabet to the world.

In mechanical structures, we find that the ancients in many things even surpassed the moderns. Their stone edifices are wonderful. We have nothing like the Egyptian Pyramids or the temples of Karnac and Ipsam-

boul, and the rock cut temple at Elephanta, near Bombay, is wonderful. In Edoru there are found rock-cut palaces in remote places, only reached through deep canons; also, uninhabited cities, the dwellings all cut in solid rock, and in a country not now capable of habitation. In Phœnicia are ruins of old walls built of pieces of stone larger than any of our ordinary machinery can lift.

There is traced a close relation in the civil government of all these nations. All possessed a somewhat republican form of government, each city possessing a district government of its own, as does now exist in central Arabia. Their religion was planet worship, and the serpent was symbolic, and there are evidences of Phallic worship among all these nations.

England has her stonehenge, so has Arabia. "Mac," signifying son, is used in Gaelic, and the African Berbers use "mac" in the same way as do the Tudas of the Indian peninsula use the term "Mag." The Irish probably came from Spain and previously from Africa.

That the Phœnicians traded to far distant places is known; therefore, why may not their ships have crossed the Atlantic? In Mexico and Central America are ruins of stone structures of a Cushite type, and in Mexico and Peru are remains of roads cut through and over mountains in almost impassible places, evidences of mighty work. We find also relics of a worship similar to the ancient Cushites. In Colorado, in Arizona, in Ohio and other places are ruins of circular buildings resembling stonehenge, and evidences of sun worship.

The natives of Yucatan have traditions that a bearded white race came across the ocean from the east, and their historians describe three classes of ancient inhabitants: 1st, the Chicamecs or aborigines. 2d, the Colhuas, or first civilizers. 3d, the Nahuas or Toltecs, who came later as peaceable inhabitants, united with the uncivilized Chicamecs and secured power. The Colhuas were bearded white men, who came in the earliest times across the Atlantic. They built Palenque and other cities, and the oldest and finest monuments of the ancient civilizations, and established the great kingdom of Xibalba.

The traditions of Peru tell of a people who came by sea and landed on the Pacific coast, and the ancient Malay dialect extended across the Pacific as far as Easter Island.

Ancient Greek books speak of the island of Atlantis, great and powerful, and being in the ocean towards the west; and it is not improbable that the Phœnicians in much older times sailed thence. The mythical story of this Atlantic island, Plato describes as divided into ten kingdoms, governed by five couples of twin sons of Poseidon, the eldest being supreme over the others, and the ten constituted a tribunal that managed the affairs of the Empire. The Yucatan tradition has also ten kings of Xibalba, who reigned in couples under Hun-Came and Vukub-Came. The etymology of atlas is found in the Nahuat tongue, *atl* meaning water, and at the time of the conquest the city of Atlan existed on the Atlantic side.

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Diodorus Siculus also speaks of a great island over against Lilya, many days sail westward. Chinese records speak of their ships, during the 5th century, journeying to a country called Fa-Sang, distant 20,000 li from Ta Han, or 7,000 miles, or more.

I advise those who have not read Baldwin to get the book and read it. Also, a subsequent work of his on Ancient America.

THE ESSENTIALS OF ENGLISH GRAMMAR.*

The study of English Grammar by the younger scholars in our schools is probably as unmeaning, unsatisfactory and unprofitable as anything they can be set at. To say that they can learn to speak and write correctly without knowing anything of the rules governing the construction of sentences, and the proper use of the words composing them, seems rather paradoxical, but it is no more so than to say that one can learn to play or sing correctly without first learning the elements and principles of music. A boy of eight or ten years of age will readily perceive the correctness of such a sentence as "the fog came pouring in at every narrow chink and keyhole," while probably at fifteen he will stammer over and among the "predicate nouns," the "attributive adjectives" and the "adverbial predicates" in very helplessness.

From a careful examination of Professor Whitney's book we are convinced that it is the best work of the kind for teachers and advanced pupils in school that we have ever seen. He has undertaken to point out the essentials of English grammar only, and in doing so he avoids arbitrary rules and depends largely upon citations, quotations and illustrations for giving the learner so complete an understanding of his own language that he can state his ideas correctly and point out the principles involved in the construction of his sentences. The dissimilarity between Professor Whitney's definitions and descriptions of the various parts of speech and those of Kirkham, Lindley Murray and Smith will be so striking and interesting to those of our readers who studied grammar thirty years ago, as we did, and have not kept watch of the works on grammar used in the schools since then, that we will point a few for their edification.

At that time and by the authors above named, a verb was defined to be a word which expressed "to be, to do or to suffer." Professor Whitney describes it as "a word that asserts or declares, and hence that can stand alone or with other words as the predicate of a sentence." Those old teachers gave the verb five moods and six tenses. Some later writers have dropped, or attempted to drop, the subjunctive mood. Professor Whitney discards both potential and infinitive, the latter of which he calls a "verbal noun," and refers to the subjunctive as "almost lost and out of mind." He

*By Prof. Whitney, of Yale College. Published by Ginn & Heath, Boston.

also reduces the tenses to two, present and preterit, calling the others "verb phrases or compound verbal forms." We also find the verb *to be* among the "verbs of incomplete predication:" the old-fashioned present passive participle *being loved* is called a "present passive participial infinitive phrase." The passive voice is so far abandoned, with the exception of the present and past or perfect passive participle, that such a form of speech as "was broken" is described as "a passive verb phrase, composed of the auxiliary *was* and the past participle *broken* of the verb *break*."

We miss the adjective pronouns and find them classed as "indefinite pronominal adjectives." Conjunctions have been changed from "copulative and disjunctive" to "co-ordinating" and "subordinating." Other changes equally striking have been made, but we have given enough to serve the purpose named.

The chapters upon Sentences and parts of speech; Derivation and composition, and Syntax, are excellent, and full of condensed information and instruction. They seem to have received the commendation of all critics, teachers and professors who have given their views to the public, and are deserving of the perusal of all lovers of fine work.

The explanations of the causes for the various rules given are simple and clear, and, followed as they are, by illustrations and examples for parsing, these rules make a much greater impression than when arbitrarily stated in the usual manner. It appears also that much of the "tedious nomenclature" of the more recent school grammars has been cleared away, which, of course, will popularize it with the teachers, one of the most distinguished of whom says, "it is philosophical, without formality, and leads the student beyond the mere mechanics of language to its life."

It bears the evidences, in every part, of the hand of the philologist as well as that of the grammarian. In fact, we think that the former preponderates in many instances, although the style is extremely simple and unpretentious.

The objection, if there be any, seems to be that as a text book for younger students it is too lax and devoid of fixed rules, and thus too much liberty is given for the introduction of expressions which have no higher origin than rather common usage, especially in the substitution of adjectives for adverbs and the allowing of the use of the objective case after impersonal and neuter verbs. For teachers and older pupils, whose principles of correct writing and speaking are fixed, so to speak, it may be well enough to depend upon illustrations to give a certain necessary freedom or absence of formality of style, but to beginners, too much rigid adherence to absolute rules cannot be inculcated.

We also think that the author might have been a little more particular in the selection of some of his illustrations, as they involve forms of speech and grammatical construction which are not, as far as we can observe, provided for among the rules laid down.

We also observe a carelessness in the construction of some of the sen-

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tences and in the punctuation of parts of his Preface, which is hardly compatible with good grammar, and inclines us to think that he has carried to too great an extent one of the theories advanced in this preface, that "correctness in writing is only one (of the purposes of the study of English grammar) and a secondary and subordinate one at that—by no means unimportant, but best attained when sought indirectly." Such things are undoubtedly due to the fact that an eminent philologist is liable to overlook some of the *minutiæ* in giving attention to the great principles involved in the discussion of the subject.

The arrangement of the work is admirable, and the typography and general execution of the mechanical part are far superior to that of the ordinary run of school books.—[Ed.]

SCIENTIFIC MISCELLANY.

THE ADULTERATION OF FOOD.

We take the following extracts on the adulteration of food from an article which recently appeared in the *Evening Post*:

"While it is certain that needless alarm is frequently excited by exaggerated statements regarding food adulteration, there can be no doubt that many of the articles of food met with at our tables often contain foreign ingredients which are introduced either for the purpose of lessening their cost or improving their taste and appearance.

Flour is subjected to adulteration with other and inferior meals, such as rice, beans, rye, potatoes, and Indian corn, the addition of which cheapens the price and in some cases bestows a good color upon a damaged or inferior grade, or causes it to take up an abnormally large quantity of water. The addition of foreign meals to flour is practised, however, almost exclusively in Europe, as most of the substances of this class used have in this country a greater value than pure wheaten flour. A more probable adulteration with us is the use of alum and mineral substances; the former is occasionally employed to impart a white color to the flour, the latter, which include sulphate of lime, kaolin, chalk, and bonedust, being used to produce increased weight. It has quite recently come to light that a flour containing ten per centum of a mixture of chalk, plaster of Paris, and barytes has for some time formed a steady article of export from Holland into other European countries. The presence of such substances as these can be detected by placing the flour in a long tube nearly filled with chloroform, shaking the mixture, and allowing it to stand, when the pure flour will rise to the top of the liquid, the heavier mineral adulterants sinking to the bottom.

Bread naturally contains the foreign ingredients added to the flour from

which it is made; but in addition to these, other substances are used in its preparation. Alum is employed to prevent the action of the diastaste upon the starch, and to prevent the bread from becoming sour and mouldy; and although this salt tends to accomplish these results and imparts a fine white appearance to the bread, its use is not justifiable. When taken into the stomach it is liable to occasion acidity and dyspepsia; furthermore, it prevents a solution of a large proportion of the gluten of the bread, thereby causing a decrease of its nutritious value. A far more reprehensible adulteration consists in the addition of sulphate of copper, which has the same effect on the color of the bread and on the diastase. Although this salt is but seldom employed, and then in very small amounts, its use is to be condemned in the strongest terms, as it acts as a virulent poison, and its effects are cumulative. A simple and delicate test for detecting the presence of copper is to moisten the suspected bread with a few drops of solution of ferrocyanide of potassium, which will cause a pinkish color to become apparent if the metal be present.

Pickles and preserves are often artificially colored. The deep green color frequently noticeable in the former is almost invariably due to the presence of a sort of copper (the sulphate or acetate), which is either directly added to them or is produced in using copper vessels in their preparation, both methods being recommended in several cooking books. This adulteration can be detected by allowing a piece of clean and polished iron to remain immersed in the pickling vinegar for a few hours; in presence of copper a thin coating of this metal will be deposited upon the iron.

The condiments used at the table are also frequently far from pure. Additional acidity is often imparted to vinegar by the addition of sulphuric acid, the use of which was formerly considered necessary in order to prevent its decomposition, and was allowed by law in Great Britain; but although the fallacy of this belief has been demonstrated, the practice is still resorted to. A few weeks ago five carloads of vinegar received in Washington from Chicago were found to contain over fifty-four grains of sulphuric acid per gallon, in the form of suphate of lime, in addition to five grains per gallon of the free acid. On adding a little nitrate of baryta to vinegar containing sulphuric acid, a heavy white precipitate will be immediately formed.

The sophistications practiced upon tea are large in number and often harmful in character. The greater part of the adulteration occurs in China, but the English and Americans appear to have become skillful imitators of the Chinese in at least some branches of this nefarious industry. Mineral and organic substances are used to increase the weight and bulk of the tea; fictitious strength is imparted to it by the addition of certain vegetable substances and pigments are employed in order to produce a desirable color. The operation which is most generally carried on, at least in this country, is the artificial "facing" or coloring of teas. This practice is almost entirely confined to green teas, of which, it is said on high authority, but few

grades reach the consumer in a pure state. The pigments most used for coloring green teas are Prussian blue, indigo, turmeric and china clay; the peculiar glossy appearance they frequently present being produced by means of black lead, talc, and soapstone. Other and far more dangerous substances, such as arsenite of copper, chromate of lead, and Dutch pink, are said to be sometimes employed. When hot water is poured upon a faced tea, the coloring matter present often becomes detached and either rises to the top or sinks to the bottom of the liquid, forming a sediment which can be readily recognized as a foreign body, especially by aid of a magnifying glass.

Coffee is probably more extensively adulterated than any article yet mentioned. When sold in the ground state it almost invariably consists of a mixture containing little or no coffee and a great deal of chicory and roasted grains, such as peas, beans, rye and wheat. The addition of chicory is frequently defended on the ground that it improves the taste and quality of the coffee; but owing to its comparative cheapness, there is a great temptation to use an undue quantity of this substance, and unless the amount of the addition is specified on the packages (as is required in several European countries), it undoubtedly constitutes a true adulteration; moreover, chicory itself is very often mixed with foreign substances. Pure coffee will remain floating upon the surface of the water for some time, and fails to impart a perceptible color to it, whereas chicory and beans (especially the former), at once sink to to the bottom and color the liquid decidedly. Other substances which also rise to the surface of the water can be easily distinguished from coffee by their appearance and taste. A simple test is to spread the coffee out on a slip of glass, slightly moisten it with water, and then touch the layer in different parts with the point of a needle; in this way the presence of soft, non-resisting foreign ingredients can be easily detected.

The artificial coloring of confectionery also merits consideration, owing to the important sanitary effects involved. One of the most common and deleterious substances used in the coloring of confectionery is chromate of lead, which is employed for the production of a yellow color. Red, another favorite hue, is obtained by means of cochineal, but such poisonous compounds as red lead and vermillion are also sometimes used for its production. Green and blue colors, which are fortunately less often met with, are usually produced by means of Prussian blue, Brunswick green, Scheele's green, etc., all of which must be classed as dangerous substances. These colors can be obtained by using vegetable dyes which are quite harmless; and although the tints are then less brilliant, this fact is certainly no excuse for resorting to poisonous pigments.

In most foreign countries effective means have been adopted to expose and prevent the adulteration of food, but with us little has been accomplished in this direction. In Europe boards of public analysis are appointed, who carefully examine suspected articles of food; here this duty usually devolves upon some member of the local board of health, whose time, as a rule, is fully

occupied by other employment. During the last few years our Custom House officials have exercised commendable care in regard to the quality of the drugs admitted through the customs, and the questions naturally arises: Should not at least equal importance be attached to the subject of the purity of the food sold by our grocers and consumed by our families?—*Scientific American.*

REMOVAL OF STAINS FROM WOVEN FABRICS.

The following practical hints on this subject, condensed from the best foreign sources, will furnish the readers of the *Journal* much useful information in small space:

Mechanically attached particles may be removed from all fabrics by beating, brushing, and allowing water to fall from an elevation upon the wrong side of the goods.

Mucilage, mucus, sugar, jelly—Washing with lukewarm water will clear all goods.

Fats.—From white goods, wash out with soap and lye. Colored cottons, wash with lukewarm water and soap. Colored woolens, lukewarm soap and water, or ammonia. Silks, clean carefully with benzole, ether, ammonia, magnesia, chalk, clay, or yolk of eggs.

Oil colors, varnish rosin.—From all fabrics except silk, oil of turpentine, alcohol, benzole, and then soap. Silks, benzole, ether, and soap very carefully, and in a very weak solution.

Stearine can be removed from all goods with strong, pure alcohol.

Vegetable colors, red wine, fruits, red ink.—From white goods, sulphurous vapor or hot chlorine water. Colored cotton or woolen goods, wash in lukewarm water and soap, or ammonia. Silks may be treated in the same manner, but very cautiously.

Alizarine inks.—From white goods, tartaric acid; the older the spot the more concentrated. Colored cottons or woolen goods, if color permits, dilute tartaric acid. Silks, as before but with great caution.

Blood and albuminous spots.—Simply washing out with lukewarm water, for all kinds of goods,

Rust and spots of ink made of nutgalls.—From white goods, hot oxalic acid, dilute hydro-chloric acid and then tin filings. Colored cottons or woolens, citric acid may be tried. White woolens, dilute hydro-chloric acid. Silks, nothing can be done without increasing the evil.

Lime, lye and alkalies in general.—From white goods, simply wash in water. Colored cottons, woolens or silks, much diluted citric acid, drop by drop upon the moistened spot, to be spread around by the finger.

Acids, vinegar, sour wine, fruit juices, etc.—From white goods, simply washing; in the case of fruit also with hot chlorine water. Colored goods either cotton, wool or silk, according to the delicacy of the material and the

color, more or less diluted ammonia, to be spread around on the spot, moistened, drop by drop, with the tip of the finger.

Tar, wheel grease, as also fat, rosin, carbonaceous particles, and wood vinegar.—From white goods, soap with oil of turpentine, varied with the action of falling water. From colored cotton or woolens, hog's lard to be rubbed on, and then soaped, and allowed to remain quietly; then washed alternately with water and oil of turpentine. From silks, as in the preceding but more carefully, and instead of turpentine, benzole and a continual current of water falling from a height, and only upon the reversed side of the spot.

For cleaning silks soiled and greased, but not thoroughly discolored by acids, etc., the best agent is ox-gall diluted with lukewarm water and strained. Blood and albumen should simply be soaked in cold water.

Superficial loss of substance by scorching.—For white goods, rub over thoroughly with a pad dipped in hot chlorine water. Colored cotton or woolens, whenever possible color over or raise up the nap. With silks nothing can be done.—*Boston Journal of Chemistry.*

THE DEVIL FISH.

At a meeting of the Chicago Academy of Science, Dr. Velie made a report of his explorations along the coast of Florida, in search of natural and archæological curiosities. On this trip, he was accompanied by his brother Mr. A. E. Velie, of Aurora, and Dr. Hammond, of Genesseo, Ill. The expedition was rich in results, and the Doctor brought home with him a very large collection of valuable specimens for the museum of the academy His report was very brief, consisting of little more than a description of his voyage and a list of the curiosities which he had collected.

Not the least of these was a devil fish, which formed the subject of a paper by Professor Peabody, who entered minutely into its character, disposition, and habits. The body of the fish was large, the transverse exceeding the longitudinal diameter, skin rough, but without any evident tubercles or spines; head not distinct from the body, subtruncate in front, slightly convex; mouth subterminal, with very small teeth in seven or eight rows; nostrils small, and placed near the angles of the mouth; eyes prominent, lateral, and placed on eminences at the base of the frontal appendices; bronchial apertures narrow, linear varying from one to two feet in length, with valvular covering; tail long, slender, subcompressed, terminating in a slender extremity; dorsal fin at base of tail, small and triangular. The dimensions of Dr. Velie's specimen are as follows:

Width at pectorals, 10 feet 2 inches; length, exclusive of tail, 5 feet 5 inches; length of tail, 4 feet 2 inches; thickness of body, 1 foot 6 inches; length of frontal appendices, 1 foot; width of frontal appendices, 6 inches.

The back of the male is black, while the female has a broad, angulated belt of a lighter color crossing the back immediately behind the eyes. The

specimen captured by Dr. Velie is a female. It is a comparatively small fish, as those described by Elliott and De Kay were seventeen or eighteen feet in width, and others of equal dimensions have frequently been encountered, though rarely captured.

Professor Peabody related several anecdotes illustrative of the strength of the devil fish. One, eighteen feet broad, towed a thirteen ton schooner, with all sails set, in the face of a brisk wind, until the harpoon drew out and the fish escaped. Dr. Velie experienced great difficulty in making his capture. He harpooned five other fish, but lost them all. The one captured succumbed only after an hour's struggle. Among the means of assault which the fish possesses are its frontal appendices, which are movable, and with which it can seize and hold, as by power of suction, anything coming within reach. In this respect only does it resemble the devil fish known to the readers of Victor Hugo. The food of the devil fish has been supposed to be crustaceans. Some scientists are of opinion that it lives on other fish, but no scales have ever been found in its stomach. The stomach of Dr. Velie's specimen contained a large quantity of a reddish, moss-like substance, which Professor Reinsch, of Bavaria, one of ths members of the Chicago Academy, identified as sea-weed, possibly a new species.—*Chicago Tribune.*

THE PLANET MARS, now so near us, has had to give up another of his secrets. Prof. Hall, in charge of the great telescope at the Naval Observatory at Washington, has discovered two satellites of that planet. The discovery was made last Thursday night, and was fully tested afterwards by the astronomers at that station. Prof. Newcomb telegraphed the discovery to the European observatories. It is looked upon as one of the most marked astronomical events of the century, and a great triumph for the new telescope. Prof. Hall says:

"The first satellite of Mars was discovered in the Naval Observatory at Washington on the night of August 16. It was first seen at 11:42. It has been observed in the nights of the 16th, 17th, and 18th of August. The time of the rotation of this satellite about Mars is about thirty hours; its greatest apparent distance from the center of Mars is eighty seconds of an arc. I think I saw another satellite Saturday morning about 4 o'clock, but of the existence of the second satellite I am not absolutely certain. I believe, however, that there are two, and expect to be able to determine this to-night. In its appearance it is a faint object of about the thirteenth or fourteenth magnitude. It was possible to discover the satellite only by putting Mars, which is exceedingly bright, out of the field of the telescope, so as to get rid of the bright light of that planet."

The distance of the first satellite is from Mars about 13,000 or 14,000 miles, and its diameter probably not more than 50 to 100 miles, and is nearer than the satellite of any known planet.—*Kansas City Journal of Commerce.*

DISTINCTIVE FLORA OF ARIZONA.

J. A. SPRING, a botanist of Tucson, sends to the San Francisco *Post* an account of the distinctive flora of Arizona. Some peculiar uses of the strange plants are described. The candelabra cactus has been employed by the Apache Indians for communicating signals; its height is fifteen or twenty feet, but occasionally specimens are found fifty feet high. To make it a signal light it is only necessary to set fire near the ground to one of the vertical rows of prickles with which the plant is adorned; the flame runs to the top, and the candelabra becomes a torch. But the plant is not destroyed, nor apparently injured, by such burning on the surface. When dead and dry the wood is found to be hollow, and it separates at once into a number of sticks or poles, these having been chiefly held together by the rind. The fruit of this cactus makes a pleasant preserve. That of another, the "prickly pear," is well known to travelers. The young leaves of the prickly pear cactus are cooked as a vegetable, the dish produced being something like string beans in appearance and taste; the leaves are also highly esteemed for use in making a poultice to draw a splinter. The "nigger-head" cactus furnishes ready-made fish-hooks in countless numbers; by surrounding the plant with fire it produces water for the thirsty traveler, the heat driving its fluid to the interior, whence nearly a half gallon is obtained. "Maguey" is a palatable preparation made by roasting the leafy heads of the century plant; it saved a whole garrison in Arizona, ten years ago, from scurvy.

EDITORIAL NOTES.

CLOSE OF THE FIRST VOLUME.

With this number of the REVIEW the first half year of its existence closes, and upon looking it over we are pretty well satisfied with it. We have given our readers three hundred and eighty-four pages of good, substantial, reliable reading, and have distributed for our advertisers six thousand copies of a handsome, well printed periodical, in more than half of the States in the Union, but especially in Kansas, Missouri and Colorado, where it has reached not less than four or five times as many readers. We have been cordially welcomed by the scientific periodicals of the country, and already number most of them among our exchanges, and have received compliments and congratulations from the daily and weekly papers on all sides.

We have published original articles from some of the best observers, writers and scientific workers of the West, such as Broadhead, Kedzie, Snow, West, Halley, Berthoud and Crosby, and compilations and condensations which have cost us a great deal of labor and time, besides selections from many of the best journals in the world. The main thing wanting now to make the REVIEW a permanent success is more subscribers and a few more advertisers. We feel that we ought to have both, not as a gratuity, but simply because our periodical is worthy of them, and will repay both as a business investment.

THE *Boston Journal of Chemistry* notes that at a recent meeting of the Massachusetts Dental Society, in Salem, Dr. S. F. Waters stated that the application of bi-carbonate of soda, that is, plain cooking soda, to be found in all

households, or other alkalies in a neutral form, would cause instantaneous cessation of pain from the severest burns or scalds, and that in all cases of mere superficial burning the treatment would effect a cure in the course of a few hours.

THE Fourth of July was celebrated at Summit, Colorado, by a snow-ball party, on snow-shoes, which afterward resolved itself into a flower-gathering party, the situation admitting of persons standing on the snow three feet deep and picking a large variety of Alpine flowers from the uncovered ground beyond the snow.

THE POPULAR SCIENCE MONTHLY for September opens with another able original paper, by Herbert Spencer, on the development of the domestic relations. The next article, "Odd Forms among Fishes," is by the late Professor Sanborn Tenney, who gives a very interesting account of sundry curious divergences from the typical pattern in this division of animal life. The Observatories of Italy are briefly described in the third article, with the work that each is doing. "On Drops" is a short but fully illustrated account of some remarkable experiments, showing the curious shapes which drops of fluid take on striking a hard surface. "Civilization and Morals," by Mr. J. N. Larned, is an instructive discussion of man's various relationships. The eighth article, "Instinct and Intelligence," by W. K. Brooks, of John Hopkins University, is of great interest, as tending to show that the distinction hitherto erected between men and animals in this regard has no actual existence in Nature. Among the five other papers that go to make up the body of the magazine, all of which will fully repay the reader, there is a short but incisive article on "The Labor-Question;" and a sketch, with portrait, of Prof. Simon Newcomb. The departments including Correspondence and Editor's Table are, as usual, full of interest and instruction. They contain pointed discussions of current scientific questions, notices of the latest scientific books, and, in the Popular Miscellany, brief but clearly-written abstracts of recent papers, and descriptions of new discoveries from the principal centers of scientific activity both at home and abroad.

OUR old friend and fellow-citizen, Gen. Wm. H. Powell, has become general manager of the Belleville Nail Works, at Belleville, Ill., and has taken out a patent for a method of converting old railroad iron into first-class nails, which is described by the *Mines, Metals and Arts* as follows: "The result of various experimental tests show the following combination of materials to be the most desirable: 56,000 lbs. of old rails, 3,000 lbs. No. 2 pig iron and 3,000 lbs. of wrought scrap, producing 26 300-2240 tons of muck bar, which is a day's production. Gen. Powell's patent covers the method of piling the faggot so as to secure a homogeneous bloom, which results as follows: The faggot is piled to so secure a perfect interspersion of the good heads, added to muck bar and cindery scrap, with the shanks and flanges as to realize in the next pile and the plate rolled therefrom strong, tough and smooth nail plates. In this process the waste is less than six per cent., and good nails are produced under the Powell process fifty cents per keg below the cost of nails made by the current system."

DR. FLEURY, of Bordeaux, a French physician, finds good physiological grounds for the habitual use of the right hand instead of the left. He says that in human brains the left anterior lobe is a little larger than the right one. There is also an unequal supply of blood to the two sides of the body. The brachio-cephalic trunk, which only exists on the right of the arch of the aorta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger. The left lobe of the brain, therefore, being more richly hæmatosed than the right, becomes stronger; and as, by the intersection of the nervous fiber, it commands the right side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the natural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery.

MR. ALLAN BAGOT, consulting electrician, of London, England, writes to the *Colliery*

Guardian that stockholders in gas companies need not seriously alarmed by the prospect of M. Joblochkoff's electric light superseding gas for street light. First, because of the great liability to damage, and difficulty of repairing of the wires, etc.; second, the expense of organizing a successful system of lighting street lamps; third, the necessity of replacing the exhausted candles hourly, if M. Joblochkoff's system be adopted.

HISTORICAL SKETCH OF MARIETTA COLLEGE (Ohio), by Rev. I. W. Andrews, L.L. D., President.

This institution was founded December 17, 1832, and from that day to this has made steady progress, never having suffered from dissensions among its trustees or faculty, and never having been "puffed up" by any remarkable periods of success. It has always had the best of professors and teachers, and has regularly graduated its classes and sent out men, full armed, who have been a credit to the institution wherever they have gone. The college was originally molded upon the New England type, and its course of study and general plan continues to be substantially the same as at Dartmouth, Middlebury, Amherst, Yale and Williams colleges.

The libraries, aggregating 27,000 volumes, have been selected with the greatest care, and some 15,000 of the most valuable books were purchased by the late President, Henry Smith, D. D., in Europe, at a cost of less than one-third the price they would have cost in this country. At the death of the eminent naturalist, S. P. Hildreth, M. D., his large and most valuable collection of minerals, etc., was given to the college; in addition to which it has a most excellent cabinet, largely accumulated by Prof. E. B. Andrews.

The course of instruction and requisites for graduation have always been of an unusually high standard for a Western college, and many of the alumni of Marietta have become professors in other colleges both east and west of Ohio. The town of Marietta itself is a most delightful place of residence, and no college that we know of presents more advantages to the student, either in a literary or social point of view.

THE London *Telegraphic Journal*, for July 15th, comes to us adorned with a striking photograph of the eminent scientist, Michael Faraday, who was born in 1791, and after a long and most successful life, died in 1867. His studies and experiments were chiefly in the departments of electricity and magnetism, and so universally recognized were his talents and ability that "he was decorated with no less than 95 titles and marks of merit, including the Blue Ribbon of Science, for, in 1814 he was chosen one of the eight foreign associates of the French academy."

WE are informed that since the article on the Wyandotte gas well was written the Company has made a contract for laying the mains into the City of Wyandotte, so that we shall soon be able to test not only the quality but the quantity of the gas from this natural reservoir. Should both equal their expectations it will prove a very valuable discovery for the manufacturers of this immediate region.

PROFESSOR SNOW'S article on Entomology which we publish this month, was read at the last annual meeting of the Kansas State Academy of Science, and copied by us from the Leavenworth Daily *Times*. It is an excellent and most practical paper, full of useful information upon a rather neglected branch of popular education.

PROF. E. L. YOUMANS is engaged upon an "American Household Cyclopædia," a dictionary of all things pertaining to domestic life, to be published this fall by D. Appleton & Co.

BOOK NOTICES.

MACMILLAN & Co., publishers of scientific works, London and New York, have sent us the following SCIENCE LECTURES FOR THE PEOPLE, viz:

Why the Earth's Chemistry is as it is: three lectures by J. Norman Lockyer, F. R. S.

The Succession of Life on the Earth: three lectures by Prof. W. C. Williamson, F. R. S.

What the Earth is Composed of: three lectures by Prof. Roscoe, F. R. S.

The Steam Engine: by F. J. Bramwell, Esq., M. Inst., C. E., F. R. S.

Outlines of Field Geology: by Prof. Geikie, LL.D., F. R. S.

All of these are handsomely illustrated and constitute a series of most interesting and valuable contributions to the literature of popular science. We have already published several extracts from some of these and shall avail ourselves again of them as occasion arises.

THE MONTHLY WEATHER REVIEW, July, 1877, issued by the Signal Office, Washington, D. C., depends upon all data received up to the 14th August from the Canadian Meteorological Service, the United States Navy, the Army Post Surgeons, Voluntary Observers and the United States Signal Service, and contains classified reports and information upon the following subjects, viz: Barometric pressure, with chart; Temperature of the Air, with isothermal chart; Precipitation, with chart showing general distribution of rain during the month; Relative Humidity; Winds, with chart; Verifications of Predictions, with detailed comparisons of the tri-daily weather indications with telegraphic weather reports for the succeding twenty-four hours; Navigation, with chart showing highest and lowest readings on river gauges for the month; Temperature of water in rivers and harbors: Atmospheric Electricity as observed at hundreds of stations; Optical Phenomena, such as solar halos, lunar halos, mirage and rainbows; Miscellaneous Phenomena, such as the beginning of harvest at numerous points, ripening of fruits, blooming of flowers, flight and appearance of insects, polar bands, sunsets, meteors, earthquakes, etc.

The most interesting features have been: First, the few storms reported at sea; second, the unusually large number of tornadoes occurring the first ten days of the month; third, the general diminution of grasshoppers and locusts, and the slight amount of damage done by them as compared with the several years previous. This is a most interesting and valuable work, and should be made far more accessible to the public than at present in order to accomplish a tithe of the good that it ought to do.

OLIVER DITSON & CO., of Boston, who also have branch houses in New York and Philadelphia, seem to lead all other musical establishments in the production of popular pieces. They have recently sent us the following songs: "The Dust of a Rose," by J. R. Fairbank; "Little Jack Frost," a piquant little thing, by Mrs. Carleton, and "I Can't Sing for Gold," by McCarroll, which abounds in beautiful sentiments and excellent music. Also three instrumental pieces entitled respectively, "Little Bells," or "Gustav's Glockchen," by Koelling; "The Czar's March" and "Out in the Green," of which we prefer the first, although all are sweet and attractive.

ELECTRICAL CONDUCTION, by R. C. Kedzie, Professor of Chemistry, State Agricultural College, Lansing, Mich., pp. 8.

This little pamphlet consists of a series of very ingenious and apparently satisfactory experiments, made to test the question whether electricity passes by the surface alone or through the whole substance of the conductor. Prof. Henry, of the Smithsonian Institute, having decided that galvanic electricity passes through the substance and atmospheric electricity by the surface, Prof. Kedzie proceeded to make sundry experiments which can hardly be described without illustrations, but which resulted in proving to his satisfaction "that the conduction of electricity of whatever name is through the mass of the conductor and not by surface action, such as is exhibited in the statical condition of electricity," which accords with the belief of the mass of eminent electricians of Europe and America.

MR. DARWIN ON THE FERTILIZATION OF FLOWERS, by Thomas Meehan, Phila, Pa.

This is a critical dissertation upon Darwin's "Cross and Self-fertilization in the Vegetable Kingdom" and "The Fertilization of Orchids by Insects," reprinted from the *Penn Monthly*, in which the writer, from various experiments and numerous observations concludes that "there is infinitely more self-fertilization among flowers than the advocates of insect agency have of late years been contending for; that cross fertilization as developed to advantage by Mr. Darwin's artificial experiments is an almost impossible occurrence in most cases in nature,

and where it must and does occur the fact is capable of a very different explanation.

REMOVAL OF HARDENED SECRETIONS FROM THE NASAL PASSAGES, and A SIMPLE MODE OF CLEANSING THE NASAL AND PHARYNGO-NASAL PASSAGES, by Thomas F. Rumbold, M. D., St. Louis, Mo., reprinted from the *Chicago Medical Examiner*.

Both of these articles are eminently practical and deserving of a wide distribution. The subject of catarrh has never been very thoroughly understood, and anything tending to elucidate it and render the disease amenable to rational treatment should meet with a hearty welcome from both patient and practitioner.

THE LIBRARY TABLE, Vol. III, No. 9, H. L. Hinton & Co., New York; weekly, 16 pp. quarto; $3.00 per annum.

This consists of book notices, literary gossip and reviews, and is a very readable and valuable periodical. One of its novelties is that the names of the writers are all signed to their articles. The last pages are devoted to an index of magazine articles, made up from the various periodicals of Europe and the United States, and a record of new books.

MONTHLY REPORT OF THE KANSAS STATE BOARD OF AGRICULTURE, for July, 1877, by Alfred Gray, Secretary, containing reports of Condition of crops and farm animals, Fruit crops and supply; Crop reports of acreage by counties, Dairy products, Garden products, Wheat market, Fish culture, etc., etc. We have before referred to this report as a very valuable one for the people of Kansas and are glad to see that its interest is fully kept up.

THE AMERICAN JOURNAL OF MICROSCOPY AND POPULAR SCIENCE, published monthly in New York, by the Handicraft Publication Co, has been sent us, with all the back numbers of this year, and we gladly welcome it as an exchange. It is a sixteen paged octavo, illustrated, and will be found a useful and entertaining magazine to those interested in the subject of microscopy. 50 cents per annum.

BANCROFT'S MESSENGER, July and August, 1877. A. L. Bancroft & Co., San Francisco, Cal.

This is a bi-monthly publication intended partly as a medium of intelligence concerning literary subjects, such as new books, music, artistic printing, etc., and partly as a means of advertising their own business.

THE CENTRAL BAPTIST, Vol. XII, No. 31, Yeaman & Ferguson, St Louis; weekly, 8 pp; $2 50 per annum, is one of the best denominational journals in the West, and should receive the universal patronage of the Baptists of Missouri and the West.

REPORT ON PAUPERISM AND POOR LAWS in Sweden and Norway, by C. C. Andrews, United States Resident Minister at Stockholm. 32 pp. octavo.